

In This Issue
BUILDING THE
CONSOLIDATED B-24

JAN.
1942

AVIATION

The Oldest American Aeronautical Magazine

McGraw-Hill Publishing Company, Inc.

Price 50c. per copy



Twin Wasps for PCA's new Lodestars

Operating between many of America's busiest industrial centers, Pennsylvania-Central Airlines is providing a service of national importance. To meet the need for still greater air service to these capitals of industry, PCA has ordered a fleet of Lockheed Lodestars—powered by dependable Pratt & Whitney Twin Wasps.

PRATT & WHITNEY AIRCRAFT
EAST HARTFORD, CONNECTICUT
ONE OF THE THREE DIVISIONS OF UNITED AIRCRAFT CORPORATION



Climbing to a New High.

in

WEIGHT SAVINGS and Assembly Speed with the

Speed Nut System

THE FASTEST THING IN FASTENINGS!

Most SPEED NUTS for aircraft actually weigh only 30% to 50% as much as fasteners formerly used in same locations. They are applied about twice as fast and also give your assembly a double spring tension lock. In resistance to vibration loosening, they are four times tougher than conventional fastenings.

Long before the Defense program started, over a billion

TINNERMAN PRODUCTS, INC.
MANUFACTURERS OF PATENTED SPEED NUTS

IN CANADA Wallace Kress Co. Ltd., Hamilton, Ontario

2715 FULTON ROAD
CLEVELAND, OHIO

IN ENGLAND Simmonds Ammunition Ltd., London

OVER A MILLION IN USE—OVER 500 SHAPES AND SIZES



Symon at present type U.S. dive bombers as well as constantly increasing performance in the Curtiss Helldiver. It designs static strength and pressure. It will be built in large quantities at the new Coffey Weight plant at Columbus, Ohio.



SPEED NUTS had already been used in reconditioning the assembly of automobiles, refrigerators, radios, stoves, ranges, heaters, etc., and cut average net assembly costs 90%.

Any assembly line using SPEED NUTS moves faster at lower cost and turns out a better assembled product. Send us your assembly details and we will mail samples and engineering data promptly.

AVIATION

JANUARY 1942

In this issue	5
Editorial Page	53
Aeronautic War Commemorative No. 1	53
Building Morale in British Factories	54
French Lesson	56
Aviation in Brazil Shows Active Progress	56
By Alice Rogers Hooper	56

FLYING EQUIPMENT

New Vought-Sikorsky Flying Boat	By Clinton Moorehead	65
---------------------------------	----------------------	----

AVIATION MANUFACTURING

PRODUCTION—DESIGN—RESEARCH—ENGINEERING		
Building the Consolidated B-24	By Major R. H. Fleet	66
From Pint to Fast in Eight Hours	By James Morris	79
Electromech Steps Up Production		74
Ballyhoo Assembly of Air-Cooled Motors		78
Wood-Finite Airplane Parts	By Carliss L. Bates	82
X-Ray Inspection and Supplementary Techniques	By W. M. Nauneryton	84

Helicopters of Tomorrow	90	
Sergeant Aloysio A. Aviation	By E. State Wilford	95

Acetone Hydrogen Pumps	By Louis Harry J. Marx and Edward M. Green	96
AVIATION'S Checkbook of Design Details		98

Engineering News	104
New Patents on Aviation Products	105
Material Shortages	107
By Raymond Woodley	107

MAINTENANCE

Chicago and Southern's New Base	108
---------------------------------	-----

NEW PRODUCTS

New Equipment for the Aviation Industry	117
---	-----

MILITARY

Intelligence Command	By E. E. Nelson, Jr.	120
Birth of the B.A.P.		126
Prelude to War—Photographs of the South Carolina Monitors		128

AIR TRANSPORT

Lighting of the Washington National Airport	By W. C. Nease	141
Making the Technical Airport Pay		145

CIVILIAN FLYING

Ready for Defense	By William Stockemer	146
Side Slips		147
AVIATORS' Radio Page	By Conroy Welsh	151
War Overhead—Aviation's Plans	By Dale Attached	152
The AVIATION News		155

National Airlines	158	Aviation People	159
Washington Weekend	157	Transport Airlines	170
Dakota	156	Fliers	179
Aviation Headlines	155	By Raymond Shoolty	
Aviation Alarmed	155	Opinion Corner	179

Now—Pioneer Engineering brings navigating perfection still closer!



Far back in the fuselage or wing, away from the rig and paths of tension metal masses and electric magnetic circuits, the PIONEER MAGNESENYL REMOTE INDICATING COMPASS accurately reads the Pole to point your course. You can read its useful array of flight direction from as many as three indicator dials, located at vital stations. Thus Pioneer's sensing spirit for the ultimate in Flight Security moves another great step forward.

PIONEER INSTRUMENT DIVISION OF SHAWNEE AVIATION CORPORATION
Bordentown, New Jersey



★ ★ ★ ★ In This Issue—

Aeronautics is likewise presented in a new format, with primary emphasis on manufacturing and sectioning for easier and quicker reading in this period when time is at a premium. For more than a quarter of a century this publication has been dedicated to the exchange of sound technical ideas developed in this country and abroad with the ultimate objective of accelerating aeronautical progress. Through these years we have changed the editorial emphasis to customs with the needs of the times. During the first World War we carried the title Aviation and Aeronautical Engineering, and attempted to fill the need for engineering textbooks that were now existing at that time. When engineering again came into prominence in 1929 we dedicated the Aeronautical Engineering Supplement in which it was our privilege to publish many basic technical articles of lasting value and for reprints of which we have had requests many years after publication.

When production became the watchword in the late thirties we increased our content of that type of material. Now we are increasing it to still greater proportions and combining with it our usual offerings of basic engineering, design, research, and equipment maintenance articles grouped in a new section for the convenience of manufacturing readers. In addition we will offer our road sections including articles on military, transport, fixed base and airport operations as well as material of interest to our readers whose interests are more general. Expanded offerings of new equipment and flying equipment will be included as well as enlarged sections on finance, code and other subjects.

Beyond this new presentation is the sincere desire to contribute to our readers material which will help them in their work toward the common goal of American air supremacy and victory in the present war.

Since aviation in the present war is the subject of greatest interest to us all, we will load each issue with a war concentrate, summarizing and anticipating the monthly progress, and utilizing and applying lesson learned in strategy and tactics of aerial warfare. Aviation's War Correspondent No. 1 has been prepared by our Washington editor after careful study and interpretation of all available sources.

Closely associated with our war effort is the job of building morale in aircraft factories to stimulate workers to greater effort. John Mervin of Peter Forbes, who has this done in England, has while (page 56) is lead in actual operations in British factories during his recent trip abroad.

Although there are deeper strategic issues involved between management and labor, we are faced with the cold fact that these have been and always must be won over our dedicated. We feel that it is our duty to present the honest truth about the labor demonstration that led directly to the fall of France. A warning that most not go unanswered is sounded by Paul E. LaRocque, America's former French correspondent who has just returned to this country after fifteen years in France.

Now we are increasing it to still greater proportions and combining with it our usual offerings of basic engineering, design, research, and equipment maintenance articles grouped in a new section for the convenience of manufacturing readers. In addition we will offer our road sections including articles on military, transport, fixed base and airport operations as well as material of interest to our readers whose interests are more general. Expanded offerings of new equipment and flying equipment will be included as well as enlarged sections on finance, code and other subjects.

Beyond this new presentation is the sincere desire to contribute to our readers material which will help them in their work toward the common goal of American air supremacy and victory in the present war.

One of the most important of our flying planes is the Consolidated B-24 four-engine heavy bomber. Already this ship has distinguished itself in war service. Major Robert H. Strode, aircraft engineer, manufacturer, tells how this huge bomber is being built in an almost incredible quantity at his plant in San Diego (Page 66).

Time and money are being spent at Lockheed by the use of Rikotta dies for punch press work. The new process is described by Thomas James Shultz who is responsible for its development (Page 70). Electrowelding found many

applications in low production of major subassemblies for current military aircraft. Some of these are shown on Page 74. To eliminate the danger of corrosion systems overhauling workers, Associated Motors has developed rollers and auxiliary methods which have been highly effective as shown on Page 75. Everyone is sharing the same concern with war publications, and on Page 43 Captain L. Sims of Poughkeepsie, presents some new ideas. Fitch's on the use of high capacity industrial-type equipment and Langley's film are discussed by H. M. Monckevich of Aircraft X-Ray Laboratories on Page 46.

In the field of engineering and design we are privileged to present two 80-page through discussions on Helicopters of Tomorrow, Page 104, and Wildcat, the Army's newest fighter plane on Page 92. Lieutenant Max and Edward Goss continue their valuable series on hydrofoils on Page 96. Latest developments in aircraft shortages are discussed by Raymond Headley on Page 107.

Ministerial material of the month includes a story of Chicago & Southern's new base and a collection of new charts in the Maintenance Handbook (Page 108), particularly the South Carolina area, but possibly operations of our Army Air Forces will be found on Page 118, and a brief look at Mitchell Field's Interceptor Command is offered on Page 132. W. C. Nease of Washington describes the unusual lighting system at the Washington Airport on Page 141. The effects of the war on aviation finance is discussed by Sibley Atchison on Page 151.

The article of a group reporting plans for construction of the first fleet has written by William C. Shoshan. He has been first and the author tells how several of these have sprung up and how they will be used in civilian flight school (Page 156).

Late last long range flying boat is the Vought-Sikorsky S-44, the last of which is now ready for launching. Our associate editor presents a thorough technical description of this important nonstop transoceanic aircraft on Page 60.

One of the most important of our flying planes is the Consolidated B-24 four-engine heavy bomber. Already this ship has distinguished itself in war service. Major Robert H. Strode, aircraft engineer, manufacturer, tells how this huge bomber is being built in an almost incredible quantity at his plant in San Diego (Page 66).

Time and money are being spent at Lockheed by the use of Rikotta dies for punch press work. The new process is described by Thomas James Shultz who is responsible for its development (Page 70). Electrowelding has found many

Coming—

Executive Secretary Jack Frost of the Los Angeles Parts Manufacturers Association will tell how this organization has forced subcontracting in Southern California. Mr. Sibley will continue her discussion of dirigible aerostats with more photographs by Jackie Martin. MacCay's report on planes in the offing. American methods of showing factory workers their true role in the war effort will be presented.



Three ways to speed parts production with

Molded Micarta

1. DIMINISH MACHINING—

by designing more parts for molded Micarta you can eliminate or materially reduce the amount of machining that must be done in your plant or in plants supplying machined parts—like clearing the decks for production of other parts that can only be produced by machining.

2. ALLOCATE THE WORK—

the molding of Micarta can be done—in fact must be done—in Westinghouse's own plants. All you need to do is to work out designs with the help of Westinghouse specialists—then turn your production headaches over to us.

3. RELIEVE CRITICAL SHORTAGES—

delays caused by shortages of aircraft metals or other materials can frequently be relieved by seeking the part from molded Micarta—as the two pieces shown here amply demonstrate. Formerly they were the next in one of the hard-to-get materials. In Micarta, performance is comparable in all respects to former materials.

PIPER



Westinghouse

AIRCRAFT MICARTA

MANY AIRCRAFT PARTS such as Fasteners, Control Panels and Control Quadrants, are now being made economically from molded Micarta.



PIPER POINTS THE WAY TO . . .

Wings for All the Americas!

From Alaska to Argentina . . . in North America, in Central America and in South America . . . Piper planes are hourly engaged in the mass production of planes for hemispheric defense. Low in price, modest in maintenance and operating costs, these dependable aircraft are designed, engineered and built especially for pilot training. They proved their worth in the U. S. Civilian Pilot Training Program where they have outdistanced all other makes combined since the Program's inception. Other American countries were quick to recognize Piper leadership. Now, throughout all the Americas, Piper ships by the hundreds to serve the defense needs of the

entire hemisphere by providing the highest order of quick, economical pilot training. A free flight demonstration in a Piper plane may be readily obtained from your Piper Dealer. Ask him about the free course of dual flight instruction offered by the purchase of a new Piper. Prices begin as low as \$1550, F.A.R. Luck Haven, Florida, U.S.A.

FREE FOLDER showing all the Piper planes will be sent you on request to any dealer from your Piper Dealer. Or, if you send a copy of the Piper folder, full-color, 16-page catalog, it will be gladly mailed you, providing you enclose 10c in stamps or coin for postage. Address Piper Aircraft Corporation, Department AD, Luck Haven, Pennsylvania, U. S. A.

PIPER

OUTSELLS ALL OTHER LIGHT PLANES COMBINED



AMERICA'S PIONEER PRODUCER OF **MAGNESIUM** REPORTS TO THE AMERICAN PEOPLE

DEAR AMERICAN: I certify to have had my own personal effects in the great national emergency are being matched by fellow workers in other defense activities.

We, therefore, consider it our duty to report on what we have done—*are doing—and will do to meet the nation's mounting needs for magnesium.*

Magnesium is the lightest of all structural metals—a full third lighter than aluminum. Its ethical value is in contributing to American air supremacy—in saving those vital pounds that spell superior lighting speed—longer existing range—greater load capacity.

Magnesium, therefore, is of deep interest to every American who looks down the national horizons of our past—the hopes of our future.

WHERE AMERICA STOOD IN 1939

The Dow Chemical Company began production of American-made magnesium metal in 1935. It developed its own production process, advancing this country from tiny dependence upon foreign sources of magnesium supply.

But the manufacture of metal was only the first step. It required years of research and experience to develop a range of practical magnesium alloys (Dowmetals) to serve its various applications. Methods of fabrication had to be adapted to continue the operational characteristics of magnesium. And equally important, American industry had to be familiarized with this new light metal—to learn by test and experience how it could serve many needs. All these steps took time.

Despite all these factors, Dow, as the sole producer of magnesium in America, had developed by 1939 a domestic market requiring an annual production of 8,000,000 pounds—a notable accomplishment.

THE MAGNESIUM SITUATION IN 1940



Early in 1940 Dow, having already earned the right need for magnesium in the war-winning defense program, had reluctantly doubled the productive facilities at Midland plant.

Fast on the heels of this first step is a vast expansion program now under way—now starting over. In March 1940, Dow announced in business industry one of the most significant advances in modern chemical engineering—the fast extraction of magnesium metal from the sea. This was the logical result of a long experience in the chemistry of natural brines.

According to 1940 news site on the Gulf of Mexico of Texas, Texas work on a mammoth magnesium plant was started subsequent to Dow's discovery.

Working at incredible speed—using at times a considerable crew working 1600 men—the first part of this plant was completed and began production at the record-breaking rate of two months.

THE MAGNESIUM PICTURE IN 1941



On January 21, 1941, the first magnesium was poured—and cast—into Dow's Midland plant. This was the first time in history that a single metal had been so treated in commercial quantities from sea water in such a quick long straight hot water before melted.

Continued with the already doubled production of magnesium at Midland, this made available no annual production rate of 26,000,000 pounds—in an field increase in our national magnesium supply a slightly over a year!

At the year 1941 progressed to fill the production facilities for magnesium. By the end of the year American aircraft and aircraft engines produced increased. Dow's magnesium production of over 30,000,000 pounds caused a considerably greater percentage increase 15 days later was already required by aircraft industry in an earlier year.

A LOOK AT TODAY—AND TOMORROW



Today, magnesium is rolling out of Dow's Midland, Michigan, and Texas. These plants are represented only one production and production is now steadily increasing. In addition,

Dow is now building at great speed new plants for green sand that will revolutionize the steel and iron industry now at establishment in this country.

During these years when emphasis in our preparation of American industrial engineers were utilizing the light weight characteristics of magnesium, it would have seemed fantastic to think that some day the demand for the metal would meet to such stupendous limits.

Set that day in hand Dow is meeting the challenge of a great opportunity to do a national duty. And, if tomorrow were to come—Dow wants you and every American, to know well respond with every ounce of effort—since success—it is promised.



DOWMETAL **MAGNESIUM**



THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • St. Louis • Chicago • San Francisco • Los Angeles • Berlin • Brussels
CHEMICALS • INTERMEDIATES • PLASTICS • PETROLEUM • REFINERY

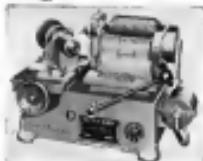
HALL ECCENTRIC VALVE SEAT GRINDING UNIVERSALLY ADOPTED FOR PRODUCTION AND MAINTENANCE

In response engine production and maintenance HALL ECCENTRIC Valve Seat Grinders have been adopted because of the finer precision and finish obtained with greater speed. Here is a partial list of HALL users: FORD (V-8 and V-12), PRATT & WHITNEY (General), PACKARD (Hudson and Marine Engines), BUICK (8 & V-8 Engines), CHEVROLET (8 & V-8 Engines), ELECTRO-MOTIVE CORP., PRATT & WHITNEY (Kingsford), PRATT & WHITNEY (Astroplane), WRIGHT (Centaur), GIBERSON Diesel Engine Co., LYCOMING, HANGER, MENASCO, CONTINENTAL, PAN-AMERICAN AIRWAYS, PENNSYLVANIA CENTRAL AIRLINES, SULLIS-BOYDS (England), ARMSTRONG-SIDDELEY (England), DELLAVILAND (England), U.S. AIR CORPS, U.S. NAVY, U.S. TANK CORPS, R.A.F., R.C.A.F.

At right, HALL AWA Universal Dual-type Eccentric Grinder set up for wet grinding valve seats in Allison engines.



At left, HALL AWA Universal Dual-type Grinder shown above is set up for wet grinding of seats in radial cylinders.



Right, HALL Model 1000 Water-Wet Grinder. This unit stores with cleaned over-all. An air-wash hand motor, this machine is easily portable and provides a smooth Hall-ground valve seat.

Above: Part of a battery of HALL Grinders adapted to Ford 8-6 P. & W. engine production.



Left: HALL EDDIE TEC Grinder used in production and service types. Operates on standard shop valves seats to obtain precision and finish without using time by reworking and resurfacing operations.



Boiler: HALL EDDIE TEC Grinder as built for Federal Airplane and marine engine production.



Left: EJA ECCENTRIC Grinder widely used for servicing valve seats located deep in intake superchargers. Also shows its limited production.



WRITE FOR CATALOG
HALL Grinders can build the valve seat grinder to exactly meet your requirements. Write for catalog to get most performance guarantee available. HALL Engineers are anxious to serve you.

THE HALL MANUFACTURING CO., TOLEDO, OHIO, U. S. A.

HALL

SYLPHON AIRCRAFT CONTROLS



LIQUID COOLED ENGINE THERMOSTAT

When cold engines must move into peak performance almost instantly—dependable Sylphon Thermostats meet the challenge, and hold engine temperature constant at the exact degree for maximum efficiency.

Operation automatically controls amount of cooling medium circulated through heat exchanger or by-passed back to engine, according to engine temperature requirements.

The thermostat is so designed that the valve position is entirely unaffected by static pressure in the cooling system, by varying pressure drops across the heat exchanger or control valves, or by changes in altitude.

The Fulton Sylphon Company's forty years of experience in the design and manufacture of temperature and pressure regulating equipment—particularly for the requirements of internal combustion engines—is at your disposal. Your inquiry will be welcome and will receive immediate attention.

SYLPHON PRODUCTS FOR THE AIRCRAFT INDUSTRY INCLUDE:

- Liquid Seal Oil Thermostats
- Oil Boiler Thermostats
- Fuel Pressure Regulating Valves
- Thermocouple Station Relays
- Non-Scaling Vacuum Regulator for Gyro Instruments
- Bellows Assemblies for Supercharger Gauges, Governor Controls, Fuel Injector Controls, etc.
- Shaft Seats for Magnets, Hydraulic Pumps, etc.

**THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE**



FIRST

Since the Birth of Aviation



1908 First Army Biplane is produced by the U.S. War Department in the United States. It has a top speed of 100 mph.



1910 First Army fighter biplane for both the Army and Navy.



1911 The first all-metal aircraft built in the United States.



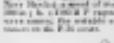
1912 First all-metal aircraft built in the United States.



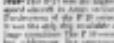
1913 First all-metal aircraft built in the United States.



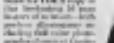
1914 First all-metal aircraft built in the United States.



1915 First all-metal aircraft built in the United States.



1916 First all-metal aircraft built in the United States.



1917 First all-metal aircraft built in the United States.

Striking Power

Combat—and plenty of it—taught Curtiss to perfect this hardest hitting fighter



Curtiss P-40 fighter. © 1942 Curtiss Aeroplane & Motor Company Inc.

• Curtiss planes were the best...and most recently—the only. Advanced built fighters in active combat in the present World War. By the thousands, they have successfully fought their opponents. The experience plus that of producing thousands of fighting planes—has led to constant improvement. As a result, today's Curtiss products are far faster, far deadlier—the harder hitting of any rolling off production lines. The striking power is far and far more than that on the early days of the European conflict.

In the expanded Curtiss-Wright organization, four of the nation's largest and strongest factories are turning all metals in producing these and six other types of military aircraft for Great Britain and the United States.

CURTISS-WRIGHT

Corporation

AIRPLANE DIVISION

BUFFALO, N.Y. COLUMBUS, O. ST. LOUIS, MO.

Congratulations!

PAN AMERICAN AIRWAYS



Aviation Maintenance Awards Winners



Snap-on salutes your achievement in the effective use of fine tools

All honor to the management and to the maintenance men whose "poling expertise" made possible the fine flying records of Pan American Airways and Northwest Airlines. And special acclaim for the "man with the wrench" whose skill and reliability played a major part in the winning of these awards—Snap-on is proud, too, of its share in providing the winners of these awards with tools indispensable in work in peace, for their speed and accuracy.



OVER 3000
KINDS AND MODELS
TOOLS FROM
SMALLEST NUTCRACKERS
TO HEAVY DUTY
BITS



SNAP-ON TOOLS CORPORATION, 8020-A 28th Ave., Kenosha, Wisconsin

Says Pan American Airways: "We have used Snap-on Tools with confidence and satisfaction since the earliest days of our service." And Northwest Airlines adds: "Efficiency resulting from use of Snap-on Tools makes possible the high maintenance standards in which we take pride." . . . Today, more than ever, for tools see of them importance . . . used in victory. Snap-on's 3,000 tool styles and sizes . . . and direct-to-you mail service . . . we conveniently assure you from 85 factory branches at key aviation centers throughout America. Write for catalog and full information.



*E*ngaging the enemy wherever found . . . under, on and above the water . . . such is the routine assignment of hundreds of these sturdy Consolidated PBY flying destroyers, now on active service.

Consolidated Aircraft Corporation
SAN DIEGO - FT. WORTH

Established 1923. Designers and builders of PBY and PB2Y long range flying boats and B-24 four-engine strategic Flying Bombers for the U. S. Air Services . . . Catalina and Liberator versions of these aircraft for Great Britain, her Dominions and her Allies.

AVIATION, January, 1943

JUST A REMINDER....

It PAYS to get in a jam!

ADEL Design Simplifies fastener tool-proof "jam" with Elastic Stop Nuts or Speed Nuts ingeniously incorporated in ADEL Stainless Steel or Dural Lure Support Blocks and Clips. Added savings in cost, weight and time . . . plus proven dependability of ADEL's patent integral retaining and bonding. Over 60,000,000 ADEL Supports now in use!

Manufactured under United States Letters Patent Number 2,353,343; 2,327,326; other United States and Foreign Patents Pending.



Eastern Sales Manager
J. HERBERT MOSELEY, Hagerstown, Maryland

Canadian Engineering Office
R. A. THOMAS, 202 Bay Street, Toronto

ADEL
PRECISION PRODUCTS CORP.

Learn AERONAUTICAL ENGINEERING

The SPARTAN Way with These Advantages



Above: The New SPARTAN ENGINEERING BUILDING, designed especially for training aeronautical and air transport engineers, is one of the most modern to be found at any aviation school in the United States.



LIBRARY BUILDING AND STUDY ROOMS IN SPARTAN ENGINEERING SCHOOL.



LIBERTY AIRPORT AIRCRAFT FACILITY WHICH IS AT PRESENT THE HOME OF SPARTAN AIRCRAFT. HERE SPARTAN AIRCRAFT PRODUCTS ARE ASSEMBLED HERE.

More and more young men are finding that aeronautical engineering and air transport engineers offer unlimited opportunities for positions well-paying careers. The most highly trained engineer is expected to exceed the supply for years to come.

With new advanced facilities such as a division of the Spartan Aircraft Company, contract to the U.S. Navy, SPARTAN is ideally equipped for the training of engineers. You get thorough specialized and ready and personalized instruction. You get a wealth of practical shop training so qualify you in shop procedure and equipment. You get great experience in apprentice engineer in the Spartan Factory to qualify you for immediate employment in the better pay positions. You get advanced training of interview caliber.

Train now for YOUR engineering career, and take advantage of the opportunity to double or triple your life income! Remember, as the average man works 40 hours a week, he will earn during his working power an all probability will be limited to \$18 to \$21 a week or \$9000 during your lifetime. But ambition and a moderate investment can prepare you for a real career in aviation with the opportunity to average \$36 to \$75 a week and earn \$60,000 to \$175,000 during your life. SPARTAN training will give you that opportunity.

SPARTAN

SCHOOL OF AERONAUTICS
DIVISION OF SPARTAN AIRCRAFT SERVICE

MAIL COUPON for Catalog giving complete information. NEXT ENTRANCE START JANUARY 5 and MARCH 30.

Reserve School of Aeronautics—Captain Maxwell W. Bellmer, Director	
Address: Dept. AIA, Tulsa, Oklahoma	
Name _____	
Address _____	
City _____	
Previous Education _____	
Age _____	
Date _____	

CHECK COURCES YOU PREFER:

<input type="checkbox"/> General Airc.	<input type="checkbox"/> Naval Ship Mech.
<input type="checkbox"/> Aviation Eng.	<input type="checkbox"/> Naval Aircraft Maint.
<input type="checkbox"/> Aviation Phys.	<input type="checkbox"/> Naval Instrumentation
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Naval Electronics
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Radio Mechanics
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Radar Mechanics
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Electronic Components
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Electronic Components
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Electronic Components
<input type="checkbox"/> Advanced Avia.	<input type="checkbox"/> Electronic Components

BUY U. S. DEFENSE BONDS



AMERICA'S DEADLY B-26 ARMY BOMBER: The most formidable fighting bomber in the world.

1942 Pledge

From 30,000 Men and Women at Martin's

America is fighting-mod. . . . So are we! . . . America is at war. . . . So are we! . . . We pledge to our fellow-countrymen our every ounce of skill, energy and patriotic devotion, that America may bear aloft the torch of Liberty, through to Victory.

Martin
AIRCRAFT

Builders of Dependable Aircraft Since 1928



**Keep 'em Flying
ALL THROUGH THE WINTER
WITH FWD TRUCKS**



**MORE DIFFERENT KINDS
OF SNOWPLOWS ARE
MOUNTED ON FWD TRUCKS
THAN ANY OTHER MAKE
OF TRUCK OR TRACTOR**

OPEN airports all through the winter are vital to National Defense and passenger flying schedules as well. First choice for the fastest, lowest in cost, most dependable method of combating snow — keeping 'em flying by keeping airport runways clear and clean — is the FWD truck. Unbiased surveys covering every state in the snowbelt and many Canadian provinces (where heavy snowfalls are a constant menace) prove that FWD's are a 4 to 1 choice for this severe service.

Canadian airports — from Newfoundland to the Yukon — use more than 85 FWD trucks, keeping landing fields and runways clear of the heavy snows typical of the Canadian winter.

The ability to smash through the deepest drifts — to knife its way through hard-packed snow and ice — the full power and traction of four driving wheels — the capacity to do a clean job faster — and still be thrifty with operating costs — these are but a few of many reasons why FWD is the No. 1 choice with experienced airport operators everywhere.



**FWD
TRUCKS**

THE PIONEER TRUCK
FOR FAST SNOW CLEARING

SNOW REMOVAL PERFORMANCE *Unmatched* BY ANY OTHER MAKE OF TRUCK OR TRACTOR

FWD trucks were first in the field of mechanized snow equipment and have held their prominent position ever since snow removal began to be accepted practice in airport operations. There are many reasons why FWD's outperform all other types of equipment in this grueling service.

An ordinary motor truck merely equipped with a snowplow attachment seldom stands up to the job, because you need the ruggedness and strength of an FWD with its balanced power on all four wheels — as double, positive traction, or truck that's "roller-truck" for the tough job of breaking deep heavy snow drifts.

You need FWD's special heat-treated steel developed to provide the maximum of resistance against failure in sub-zero temperatures — you need its special gear ratios — its tremendous reserve power — its full and balanced traction of four driving wheels — its properly calculated weight distribution that gives it stability on humpy, slippery surfaces. Heavy plows, "V" plows, plows of every practical type can be swiftly and securely mounted on FWD's because they have lugs designed with proper snowplow mounting facilities. More different kinds of snowplows are mounted on FWD trucks than any other make of truck or tractor.

When you buy an FWD you get a truck that is not only the best of its kind for snow removal service but also a truck that yields the biggest return on the investment because of its all-season usefulness on regular maintenance jobs around the airport.

Write for the complete FWD performance record on
airport snow removal and other maintenance services.

**THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis., U.S.A.
Gardiner Parkway, Etobicoke, Ontario**



FWD
TRUCKS



ONLY THE FWD FOUR-WHEEL-DRIVE TRUCK PROVIDES SO MANY OUTSTANDING SNOW REMOVAL ADVANTAGES



ACCURACY

FOR THE FIRST
LINE OF DEFENSE

LOOKING at today's whirling defense program, the first picture is that of speed—and tremendous mass production. But behind every stock picture there is one of the tool rooms—the first line of defense—where the tools and fixtures for the production line are designed and built. It is in this picture, where measurements are reckoned in eight thousandths of an inch, that you will find South Bend Lathes.

Sound design, expert workmanship and quality materials give South Bend Lathes extreme accuracy for precision tool and gauge work—smooth power and speed for efficient production—illustrating versatility for economical change-over.



SOUTH BEND LATHE WORKS

102 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

LATHE BUILDERS SINCE 1885



NEW BOOK ON WELDING



tells you
clearly

- ★ What welding process to use.
- ★ Individual weld characteristics of all commonly used metals.
- ★ Which welding procedure to follow.
- ★ How to estimate cost of welding.

Helping you select the proper welding process for a particular metal under given circumstances—that's the job that is done with unusual clarity in this new 55-page Airco bulletin. Single copies are available upon request. Please write on your business letterhead to Air Reduction, 60 East 42nd St., New York, N. Y.

Air Reduction

General Offices 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS: MAGNOLIA-KISCO GAS PRODUCTS CO.

AIRCO DISTRICT OFFICES IN PRINCIPAL CITIES



THEY HAVE
TO BE
GOOD!



UNBRAKO

KNURLED SELF-LOCKING SET SCREWS . . .

In strength and in economy "Unbrako" Self-lockers exceed by a wide margin today's demands. They have to be good, for they are generally used for tension loaded points that put "Unbrako" on a claim by claim. They assure a vibration-dampening grip even when the screw is tightened up no more than usual! And the knurled point retains its ability to lock regardless of how often applied.

UNBRAKO

KNURLED SOCKET HEAD CAP SCREWS

Standard dimensions are maintained whenever possible. Unbrako's Knurled Cap Screws quicken right to dry or cold. Because . . . one can drive or adjust without risk to hands, fingers and machine. Your mechanics will tell you how much time they save.

See it, feel it in a factory, be sure to SPECIFY UNBRAKO
ON YOUR NEXT ORDER.

STANDARD PRESSED STEEL Co.

JEROME, NEW YORK • 100-544
MOTOR • AUTOMOTIVE • AIRCRAFT • INDUSTRIAL • MACHINERY • BUILDING • CONSTRUCTION

The KHUSLING of
Socket Screws
originated with
"UNBRAKO" Years
ago.

UNBRAKO
Screw
Products

AVIATION January 1942

FOCAL POINT
of Power



THE strong arm of air power—Cyclone articulated and master rods—each transmit to the crankshaft 15-ton piston thrusts which are there converted into rotary motion. Every rod applies more than 120 horsepower to the spinning shaft. All work together in the same manner as many arms turning a windlass. A set of these radiating arms for

each bank of cylinders focuses their entire output on a single crankpin. This is the pattern of radial power.

This "power section" is the nucleus of assembly. Around it the rest of the engine grows on progressive assembly lines which today are reaching ever higher production without sacrifice of Wright precision and quality.

WRIGHT
Curtiss-Wright ENGINES

WRIGHT AERONAUTICAL CORPORATION • PATERSON, NEW JERSEY

Divisions of Curtiss-Wright Corporation

Vital for Production and Maintenance

ALUMINUM, THE FUTURE, AND YOU

RIGHT NOW OUR FACTORIES have only one interest: to make more Defense Aluminums than the world has ever seen before. Every resource we can muster is concentrated on that job.

MEN IN AMERICA HAS NOW THROUGH to make the world safe for our children to live in. ... the saying is: What a lot of aluminum is going to be available for everybody. THE REAL POINT TO PONDER is how to get set to make that usage of light metal work for you. Is the kind of world we're going to have, sure as fate, the men who fail to pull now, on every occasion at his command is going to be left at the post?

WE'VE COINED A WORD:

IMAGINEERING. It's the fine art of deciding where you go from here. It's the art of thinking out what you are going to face, and doing something about it now. **Imagining plus engineering** is a formula for the future you're going to hear more about.

A MAN CAN be producing for Defense at top speed and be imagining at once and the same time. In fact, the more he is devoted to Defense now, the more he needs imagining for **THE DAY WHEN**.

OBVIOUSLY you can imagine with steel, copper, glass, wood, plastic, or what have you. We hope you will, because the world is going to need better use of all materials than it ever saw before.

THE CLOSER YOU GET TO FUNDAMENTALS the more quickly you must decide that the great need is going to be for the very things Aluminum does best: Lightness with strength, resistance to corrosion, reflectivity, workability and all the rest of its powers all wrapped up in a low-cost package full of unlimited possibilities for you, personally, in your business.

TWO HEADS ARE BETTER THAN ONE Already, many an industry, many a company, has called us into an unceasing session. We've seen things proposed that will make new when the curtain can be lifted. Usually we've been able to help with some imagining of our own.

DOES THIS SUGGEST ACTION? WE HOPE SO.

Aluminum Company of America, Pittsburgh, Penn.

ALCOA ALUMINUM



STANDARD THE
ALBERTSON & CO., INC.



WORLD OVER

SIOUX CITY, IOWA U.S.A.



**Leaders Look to
FLEETWINGS
for Parts**

Brewster, Douglas, Republic, Vega, Vought-Sikorsky, Vultee . . . names that are synonymous with history . . . are among the many who look to Fleetwings for control-surfaces of aluminum alloy or stainless steel and other parts. * "Fleetwings" is a descriptive as well as a firm-name when it comes to putting speed into the making of fine, stabilizers, elevators, flaps, rudders, ailerons, spotters and other parts. * If you are in need of a dependable subcontractor — one who can meet your production schedules — look to Fleetwings!

Fleetwings pioneered stainless steel for aircraft and is today the world's largest manufacturer of structural aircraft parts and components of stainless steel.

FLEETWINGS
Incorporated

Reinforced
Plastics

Pressurized
Components

Now Available...
ADDITIONAL PRODUCTION OF



"SKY-DRAULIC" AIRCRAFT CONTROLS

RECOGNIZING the urgent need for hydraulic aircraft controls, Chicago Pneumatic Tool Co. has greatly expanded its facilities for the production of these essential units.

Since September, 90,000 square feet of additional manufacturing area has been available at Garfield, N. J., for the exclusive production of "Sky-Draulic" aircraft controls.

CP controls are used by leading builders for operating landing flap, beach bay doors, gun mounts, retractable wheels and similarly operated units.

To the design and production of "Sky-Draulic" aircraft controls, Chicago Pneumatic applies more than forty years' experience in the development and manufacture of pneumatic tools, electric tools, air compressors, Diesel engines and related engineered products.

Our engineering facilities are at the service of all munition users for the purpose of design and development of hydraulic controls for aircraft.

Identified with the aircraft industry since the inception of the metal plane, Chicago Pneumatic was first to develop a pneumatic riveter for airplane fabrication . . . first to produce Pneumalite aviation riveters . . . first to produce Universal and Hycycle electric tools. Today, CP airplane tools . . . largest and most complete line in the world . . . predominate in the aircraft industry.

Further indication of its recognition in the field of aviation is the selection of Chicago Pneumatic to manufacture the supercharger controls and pumps for the "Merle" Bell-Royce aircraft engines.

Expanding facilities and rapidly maturing plans for greater production now enable the Hydraulic Division to accept additional commitments for 1942 delivery of "Sky-Draulic" aircraft controls.

**CHICAGO PNEUMATIC
TOOL COMPANY**



CHICAGO PNEUMATIC TOOL COMPANY

HYDRAULIC DIVISION — Garfield, New Jersey

Branches in Principal Cities • Plants at DETROIT, MICH. • CLEVELAND, OHIO • HARRISBURG, PA. • GARFIELD, N. J.
AIR COMPRESSOR • PNEUMATIC TOOLS • ELECTRIC TOOLS • AVIATION ACCESSORIES • OTHER INDUSTRIAL EQUIPMENT • HYDRAULIC EQUIPMENT • METAL FORMS

THE RED CROSS

needs the financial aid of every American.



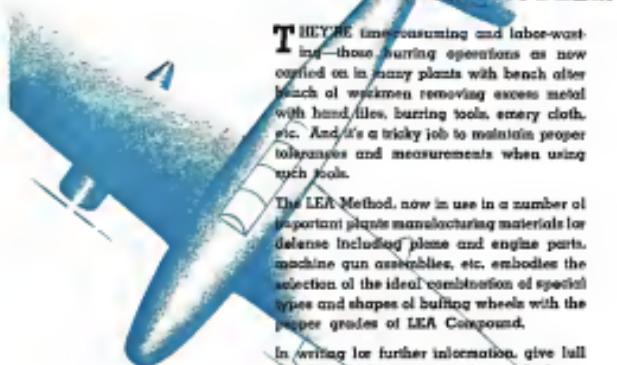
Contribute today through your Local Chapter.
Be as generous as your circumstances permit.

THIS SPACE CONTRIBUTED BY THE B&W CORPORATION

BURRING

LEA
FINISHING ENGINEERS

have worked out an economical solution to
YOUR BURRING PROBLEM



THEY'RE time-consuming and labor-wasting—those buring operations as now carried on in many plants with bench after bench of workmen removing excess metal with hand files, burring tools, emery cloth, etc. And it's a tricky job to maintain proper tolerances and measurements when using such tools.

The LEA Method, now in use in a number of important plants manufacturing materials for defense including plane and engine parts, machine gun assemblies, etc., embodies the selection of the ideal combination of special types and shapes of buffing wheels with the proper grades of LEA Compound.

In writing for further information, give full details of the buring operation to which you wish to apply the LEA Method. The part, metal and nature of operation have an important bearing on the buff and composition selected.

THE LEA MANUFACTURING COMPANY
WATERBURY, CONNECTICUT



Specialists in the Production of Clean-Working Buffing and Polishing Compounds

TIME IS SHORT!



8,760 HOURS TO GO IN '42

Men, make the most of them!

A MILLER Continuous Wireweld Fluorescent Lighting System in your plant can pack more production minutes in the man hour . . .

JANUARY 1, 1942 . . . 8,760 hours to go. Golden, long hours Harry! Harry!

Put all machines to work. Work machines all the time. Use the direct lighting methods. Build an adequate working force. Keep the working force in the man hour . . .

Squeeze every last drop of production from each precision lamp. Utilize the proven help of continuous-row fluorescent lighting. MILLER 50 FOOT CANDLER and 100 FOOT CANDLER. (MILLER inventors for years and during war.)

Pick up the efficiency of your powerwork with 50 foot candles or better of matched working light . . . a sense of America's aims and defense plants have done already.

Ask promptly (after careful consideration) and we'll pack hard-to-prime prestige deliveries—superior service. Write for helpful details. (Representatives in principal cities.)

MILLER

50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS
Continuous Wireweld Fluorescent
Lighting Systems

THE MILLER COMPANY

MERIDEN, CONN.

Proven by Good Lighting Since 1914

* MILLER offers a complete line of incandescent and fluorescent lighting equipment.

AIRCRAFT & JOURNAL, January 1942

Do you get these 5
MILLER benefits when you
buy fluorescent lighting?

(1) **BIGGER BRIGHTER**—In the time
it takes to turn on incandescent
and project weaker efficiency. Fluorescent lighting is the newest
modern lighting system.

(2) **50% LARGER INSTALLATION**—In the time it takes to turn on
incandescent lighting, you can
install fluorescent lighting in
anywhere from 100 to 1000 watts per
foot of working surface.

(3) **BIGGER INSTALLATION**—In the time
it takes to turn on incandescent
lighting, you can install
fluorescent lighting in any
place where you have
available space.

(4) **BIGGER BRIGHTNESS**—In the time
it takes to turn on incandescent
lighting, you can install
fluorescent lighting in any
place where you have
available space.

(5) **ALLOWABLE FOR FUTURE LIGHTING NEEDS**—In the time it takes to turn on
incandescent lighting, you can
install fluorescent lighting in
any place where you have
available space.

IN THE MINES,
ON THE HIGHWAYS,
IN THE SHOPS,
IN THE SKYWAYS

CLEVELAND PNEUMATIC PRODUCTS are helping America win the war!

FIVE MILES up or even miles down—below, on, and
above the precious soil of our nation, products
of The Cleveland Pneumatic Tool Co. are helping
our democracy overwhelm the forces of evil.

In the mines, Cleveland Rock Drills aid in
extending valuable ore and raw materials.
On the roads, Cle-Air Shock Eliminators for
trucks and buses contribute to the efficiency
of our vital transportation system. In countless
busy plants, Cleo Pneumatic Tools—riveters,
chippers, drills, grinders, and removers—help

meet the cry for more and still more produc-
tion. And in the air, our world-famous Avail
Seats are furnishing America's gallant pilots
with landing gear that provides the utmost in
safety and reliable service.

Thus from far behind the fighting lines to the
extreme rearmost of the skies above, where
lies the first line of battle, Cleveland Pneumatic
products are serving our country. We solemnly
pledge to continue this service by maintaining
our all-out, 100% contribution to VICTORY!

THE CLEVELAND PNEUMATIC TOOL CO., Cleveland, Ohio, U.S.A.



Typical of Cleveland Rock Drill products in this mines city with
drillers situated working in a
vertical shafts.

Cleo Shock Eliminators on trucks
and buses cut maintenance costs,
from driver fatigue, prevent roll
with corners.

This riveter is one of many types
of Cleo Pneumatic Tools spread
by production in metal-working
and sheet fabrication plants.

Avail Seats airplane seats—seats
safe landings and better air to
fuel the plane without air travel.

EMERSON ELECTRIC

A LEADING
MOTOR
MANUFACTURER
FOR 51 YEARS

Offers to Aircraft Engineers

Priceless Knowledge of Electric Motor
Adaptability, Design and Performance



REFUGERATION

Emerson engineering skill solves any power problem—whether it's refrigeration, air conditioning, heating, ventilation, or industrial processes. Emerson Electric has the knowledge and experience to help you meet your needs. General Electric Electric Motors are available from Emerson Electric. For further information, contact the Emerson Electric Division of General Electric Company, or write for "Electric Motors for Aircraft," or send name and address.

AIRCRAFT with its ever-new and ever-changing electric motor requirements, can well use Emerson-Electric's 51 years' experience in the development of precision-built electric motors. Here is an invaluable asset to Aircraft Engineers—the overall ability to answer know-how questions involving specialized electric motor applications—operating characteristics and design.

Aircraft Motors have already been designed for airplane gas turbines, hydraulic servo, fuel pumps, and tail controls—also with button gear reduction and limit stops.

FACILITIES FOR QUALITY PRODUCTION
Gated for emergency production—Emerson-Electric is flexible enough to meet the quick-change demands of mobility in design... You are invited to consult Emerson-Electric—for ENGINEERING SERVICE—FOR PRECISION-BUILT MOTORS!

THE EMERSON ELECTRIC MANUFACTURING CO.
ST. LOUIS • Branches: New York • Detroit • Chicago

EMERSON ELECTRIC

ELECTRIC MOTORS FOR AIRCRAFT

S.H.P. and Smaller

ELECTRIC MOTORS FOR AIRCRAFT

S.H.P. and Smaller

S.H.P. and Smaller

AIRCRAFT, January, 1944

TO KEEP
DEFENSE PRODUCTION
ON THE MOVE

NON-ENGINEERED PRODUCTS SOLO BY LYON DISTRIBUTORS



Steel Wire Baskets
for 14, 17 and 21 inch
drawers



Metal Tool Cabinets



Steel Racks



Metal Stools



Receptacle Baskets



Shop Boxes

1. Use LYON Steel Shelving, Tool Cribs, and Shop Boxes... To Conserve Floor Area... To Accelerate Handling of Tools and Materials... To Make Maximum Use of Minimum Inventory.

2. Use Lyon Manufacturing Facilities to Assure Speedy, Dependable Handling of Sub-Contracts Involving Fabrication of Sheet Metal Units or Parts of Units.

• Most plants handling major National Defense Contracts are familiar with the advantages of Lyon in organizing a plant for more productive storage and material handling.

Now Lyon offers Defense Industries an additional service. If your defense project involves producing runs of units or parts of units fabricated from heavy and medium gauge sheet metal, the complete facilities of our two large, modern plants are available on a sub-contract basis.

Lyon has a capable field engineering staff to help you:

1. Determine definite savings which might result from the use of Lyon Products.

2. Help you take advantage of Lyon's most complete facilities for any sheet metal work in your defense contract.

LYON METAL PRODUCTS, INCORPORATED

General Office: 1375 Madison Avenue, Akron, Ohio

Branches and Distributors in All Principal Cities

LYON Service

Storage Equipment

THE NEW BENDIX

MULTI-TUBE SUPPORT

Revolutionizes multiple line and conduit installations

Bendix Multi-Tube Supports consist of a single casting and can be installed—with any number of tubes—or braided rigs or other current methods. They meet every requirement for multiple tube installations, and they cost valuable space.

Weight savings up to 50% are achieved with Multi-Tube Supports, because a reduction of casting material is required—the supports being permanently bonded on the support with the exclusive Bendix Thermo Weld process.

Assembly is speedy and positive in the

Multi-Tube Support consists of only two parts. The electrical bonding strip is permanently attached for maximum conductivity and for insulation convenience.

Bendix Multi-Tube Supports are furnished for all combinations of line sizes and require no special dies or tools to meet any requirement—they are engineered for production as well as performance.

BENDIX
Factory of

AVIATION, LTD.
North Hollywood • California

See Below and Other Bendix Aviation, Ltd. Take Clamp Developments

End-Clamp

For small
amounts of
material or
when it is
not possible
to make
holes with
a regular
drill bit.

Bendix Custom Clamp—
available in copper and
steel. Custom Clamps
are available with various
fixtures and fittings.

Speed assembly with
Dura-Klip Clamp—one part
of each clamp holds
any assembly with accuracy
of better than one-thousandth of an inch.

Series 4000 and Series
10000 Cam-on-Clamp with
generous Speed-Mate—
one part of each clamp holds
any assembly with accuracy
of better than one-thousandth of an inch.

Example of special Bendix
Cam-on-Clamp used on
copper-copper
connection and
braided rig.

What Can I Do?

Even so far that Sunday morning when he or we opened from the stars upon Honolulu a new question has been emerging about us: resilience of American morale. It is this: What can I do to help my country win this war?

The instant question has pushed aside all manner of personal interest. From now on, individual wants and wishes must give way to the preeminent needs of the nation. We all accept that. We have undertaken a huge job. Or, I should say, we have had a huge job thrust upon us. And unless we set our feet firmly through intelligently, we'll never reach either what any of us may want.

That job is to win this war.

No longer are we trying to prepare for a war that we may get into. Today we are trying to win a war we're already in—and in up to our necks. Nothing that any one of us now can do to help himself can get him very much if it does not also help our country to win this war.

I am sure that those who read these words will feel many things to do. Some will enlist in the armed services. Some will become active in civilian defense. Some will labor to reduce burdens at their home towns. Some will work with organizations that try to move the men at the front. Each can and will find something he can do.

But the ultimate question "What can I do?" goes beyond the individual and his personal service. It reaches through the alliance and the shape of every American business concern. And what I have to say here is not directed toward individual effort. Rather it is intended for the men and women of America's industry who realize that industry is a living part of America. We like others are asking ourselves: What can industry do? Or better still, what must industry do if our country is to finish the job it has started?

Those of us who work on and with American industry have an impossible obligation. We may feel very patriotic, we may be willing to serve "in any capacity," we may be willing to sacrifice "in any measure." But if we fail to meet that one obligation, we shall fail our country in its time of need.

THAT SUPREME OBLIGATION IS AN HONEST DAY'S WORK, EVERY DAY, FROM EVERY MAN, EVERY WOMAN, EVERY MACHINE . . .

IT IS AS SIMPLE AS THAT!

And that goes for all of us, whether we are engaged in civilian production or serving directly on the war fronts of war. American victory can be won only through the profitability of America's industry.

Efficiency in production is not the responsibility of a few. It can be achieved only as we all put to useful purpose every minute of our time, every ounce of our energy, and every pound of our materials.

This responsibility of industry is the more vital because of what has happened to the business of waging war. There was a time when success in war was chiefly a matter of well-trained, well-disciplined armies and competent leaders—when men were everything in those days; military strength was a matter of strong battalions and able generals. Both still are vital. But today military might is essentially mechanized might. Modern war is an industry just as much as a factory or a school. In the first World War, mechanized equipment was relatively simple and limited. But today the special equipment of war and the expert skill needed to use it spell the difference between victory and defeat.

We Americans are not expert war-makers. That is why we must expect to suffer greater losses before we can win substantial gains. We do not have military training and experience ready to hand when we need them. Neither do we have, ready for service, enough of the machine that are so essential to modern warfare.

So, when it becomes necessary to fight for our lives, we cannot start from scratch. And today, after a year's effort, we still are not ready to strike blow for blow with our men who for years have schooled their leaders, trained and disciplined their people, and organized their industries to make war. We shall need more time to develop our strength. And while we are doing that, we must expect reverses.

But there is a brighter side to all this. Far it follows that if we are granted that prolonged time, the change in the method of waging war is right down our alley. The greater importance of mechanized equipment plays straight into the hand of the world's greatest industrial nation . . . and there in one thing America does know, it is industrial production! Our industries know how to produce. They have the skilled manpower. They have the organized facilities. Beyond any doubt, we can produce all that we need to win the victory that we must win—if only we are given the time.

THE FIRST RESPONSIBILITY OF THE ARMED FORCES IS TO GAIN THAT TIME FOR US.
THE FIRST RESPONSIBILITY OF INDUSTRY IS TO USE TO THE FULL EVERY SECOND OF THAT TIME IN PRODUCING THE WEAPONS



"WE WERE TALKING ABOUT AIRCRAFT INSTRUMENTS"

... and as I explained to this young cadet in primary training, "There's a big difference. Just like the difference between a cheap watch and a Swiss masterpiece."

"Now take my experience, for example," I went on to make the point . . .

"I learned to fly with a compass and altimeter due fell in the one back tickler class.

"That was okay for fair weather, but in this business you take it as it comes."

"So I always said if I bought a plane for myself, I'd wait until I could get what I wanted."

"Then I joined the Army. Man, it was just like having a silver spoon stuck in your mouth so far as equipment is concerned. Nothing but the finest."

The young fellow pointed to the instrument panel on his training plane.

"'Kollsman,'" I said and he nodded.

"In this man's Army you learn to fly, navigate, patrol, fight, bomb with precision instruments . . . and you need the kind you can depend on to take it in action."

"You'll get into some tight spots before and after you get your wings."

"But you'll always get home if you learn to read your instruments."

"These babies tell the truth."



APPROVED FOR MILITARY AIRCRAFT



CIRCUIT BREAKER AND "ON AND OFF" SWITCH COMBINED IN NEW SQUARE D UNIT



In multiple jobs performed, space required, weight and complexity of installation, Square D's new combination Circuit Breaker and "On and Off" Switch—with positive, snap action—offers many important advantages for aircraft equipment. This Circuit Breaker is particularly advantageous for aircraft equipment. Besides, (Class 9360) its non trip feature, so it may be held closed for emergencies—but when released, if over current is tripped, theoggle lever will snap to the "off" position.

Here are some of the advantages:

1. It eliminates fast-tripping fuses, which are more expensive.
2. It allows easier replacement of electrical circuits without the necessity of having new fuses on hand.
3. It eliminates need for pilot interconnection devices, saving on weight and unnecessary cost.
4. It combines on/off switch with circuit protection, thus reducing parts, time and cost of assembly. The switch can be held closed securely for emergencies.
5. It gives one low protection for small circuits which are not protected with conventional protection or high overhead or short circuits.
6. It gives complete control in pilot compartments and avoids the possibility of simultaneous short-circuiting in equipment. Nothing to be released.
7. It can be used for operation while the aircraft is in motion.
8. It can be installed without the usual麻烦, saving time and money.

MAY WE INTRODUCE OURSELVES?

To every user in aviation, the Square D Company may be a new name. But in the industrial and construction fields, in the integrated areas of the largest manufacturers of electrical control equipment and the leader in the production of Circuit Breakers, few brands have had the same success as Square D units are in our industry.

Out of this great wealth of manufacturing experience, coupled with that of our Kollsman Aviacon Divisions Division, the new combined Circuit Breaker and "On and Off" Switch was designed especially for aircraft operation. After proving extensive tests it was accepted for use in military aircraft.

SQUARE D COMPANY

Regester Division, 4040 Second St., Detroit, Mich.

Distributors also available

Kollsman Instrument Division, Elkhorn, New York • Glendale, California





JACOBS AIRCRAFT ENGINE CO.
POTESTOWN, PENNSYLVANIA, U. S. A. • Cable: JAECO



The message below was prepared prior to the outbreak of hostilities. We at Boeing feel its truth today as we did then. This is our pledge to America at war: The formidable 4-engine Flying Fortress will continue in case of the Boeing production line in constantly increasing numbers, for the defeat of America's enemies and for the protection of American soil.



*Whatever the New Year
may bring...*

The Boeing Airplane Company hopes 1942 will bring peace. This wish stems first of all, of course, from the natural human desire that no people and no part of the world must suffer the terror and destruction of war.

From the viewpoint of aviation's advancement, we believe that its true development can be realized only in a time of world peace. Then, when commerce and travel flow free over more, when men's minds are released from doubt and uncertainty, then—and only then—will aviation win its long-desired and rightful place in world affairs. Then will air travel and air freight become an ordinary necessity in our everyday life.

However, peace will not come through hoping, but only through hard work. Every man and every woman in the United States has a part in this work if democracy is to end this war. At Boeing we have defined our part to be that to build for the needs of democracy not only as many airplanes as possible, but to build the best.


F. C. Johnson, President

BOEING AIRPLANE COMPANY
Seattle and Everett, Washington • Wichita, Kansas • Vancouver, British Columbia

The Birdmen's Perch

This month marks a milestone in the history of the Birdmen's Perch. For the first time we have given a letter from one of our readers who admits that one of our problems was definitely too much for him!

Major Al Williams, a/cm, "Circus Wing Test," Gulf Aviation Products Manager, Gulf Oil, Pittsburgh, Pa.

Now she says don't worry this is with Gulf products! In this case, what we say "Jump in the cabana and sludge exhaust that cost us \$1000s, we swear." And we don't say it just because we're one of the few makers of successful cleaning materials used by the Gulf famous Albatross Fleet! The fact of the fact, is, that by the time you put Gulfwise in your engine's engine, more of the trouble causing sludge will not have taken root in your engine's engine! A clean running, well-lubricated engine is all we ask!

THIS MONTH'S BRAIN TWISTER

Here's a one from Mac Gatz L. Pease, of Tucson, Wash., who likes his problems to be more serious than they are:

There were once tenas who had a certain number of gallons in their gas tanks. Distance No. 1 said to No. 2, "You give me half of your gas, and then you give half of your gas, and then I'll give half of my gas, and so on." Distance No. 2 said, "Mac, you give me half of your gas, and I'll then have as much as you will then have."

How much gas was in each tank at the beginning?

THIS MONTH'S WHOPPER

Dear Mac,
Once upon a time there was a boy named Mac who wanted to buy a kite. He went to the store and asked for a kites price.

It all happened like this: Mac said, "How much is a kite?"

Now I want you to understand that Mac was a very poor boy. He had no money at all. Of course, he had to fix it up a little here and there. So he had to say the cost of the kite was \$100.00 and he had to pay him with a gold coin. Mac said, "I can't afford to spend a dollar on a kite because I have a lot of gold coins."

When I say the kite, the kite cost \$100.00. Mac said, "I can't afford to pay him \$100.00 because the kite is too expensive. So he paid him \$50.00 and he said, "I'm sorry, but I can't afford to pay you \$50.00."

Well, Mac was very poor, but he was not bad or evil, because the kite was just too expensive. The cost of the kite was \$100.00 and he didn't want the kite to cost more than \$100.00.

It may happen that one might think that Mac was being foolish, but Mac was not. The cost of the kite was \$100.00 and he didn't want the kite to cost more than \$100.00.



the base of the plane were low down, and me along as a bird that could perch and never need to fly.

"Finally I went to the top of a peak, and I decided to sit there to take a look around. Well, here I am on Devil's Tower, where eagles build their nests in the deepest places."

It would be really interesting up here if we were to see some people who happened to be here when I expect. We play right now, which keeps my mind off of my troubles."

Dear Mac, See you in a week or two.

Jump with us COAST Airlines, an airline that flies the world.

I am dropping this letter over a ledge in hopes that somebody will pick it up. Please, and we have 20 going to get down off of me, since you are responsible for my predicament.

Yours hopefully,

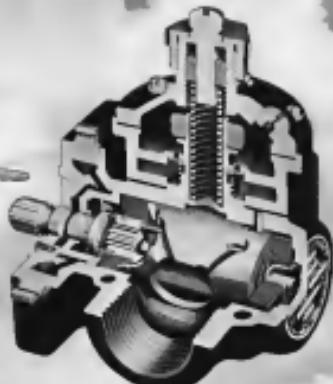
P.S. There are no birds living here from the night because all of the eagles are over there flying a party at that G. G. G.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

Gulfwise Fuel System Cleaning Products



SIMPLIFIED DESIGN FEWER PARTS LESS WEIGHT



PESCO

FUEL PUMPS

Long recognized as standards of reliability and performance, PESCO Aviafuel Fuel Pumps offer these important advantages:

- Simplified design means less parts, reduced space, lower weight.
- Fewer parts to stock for replacement.
- Required periodic overhaul accomplished more readily.
- Maintenance cost reduced.
- Universally low power consumption.
- High suction lift.
- Comparative oscillograph analysis indicates pressure pulsations 10 times or greater of those of more complicated designs.
- Spherical valve seating engagement insures greater dependability and longer life.

COMPARE THESE FIGURES

PESCO Fuel Pump illustrated above compared with other makes of similar output rating:

No. of parts*	Shape	Power Consumption
PSCO	22	2.0 hp
Pump A	40	2.0 hp
Pump B	42	2.0 hp
Pump C	31	2.0 hp
*Including fittings, wrenches and tools.		



STANDARD PESCO FUEL PUMPS FOR MODERN AIRCRAFT



PESCO Fuel Pump with spherical valve, designed for high altitude flying.



PESCO Fuel Pump with bellows valve, designed for high altitude flying.



PESCO Standard Fuel Pump, easily mastered.



PESCO Gear Pump that finds service developed for severe flying.



THE MAN WHO TILLED "UNCLE"

Dear Major Williams:

After spending 4 hours, there was no wind, trying our methods in maintaining the aircraft in the air. I had to leave the aircraft on the ground, so I thought, that I have probably overestimated the flight, nothing which I have planned out. There are no more aircrafts in the sky, so I have to leave them alone and use aeronautics domain to clear the problem in question.

All we have probably gained by this, is at least up to the fact that I GIVE UP, and would greatly appreciate your reviewing the situation on this problem.

Edward J. O'Brien
Kinston City, Missouri

DID YOU SAY "JUMP!"

We hope you didn't mean the money about the kite, because there was never any trouble with it from the start, the solar day. That's why we still have something to buy another and prevent development in the direction of Cancer. The new thing that we have added is that we have gone and had a brother, a parasite that has been jumping up. The reader had thought he said "JUMP!"





3 Plusses Ahead!

Why America's leaders write "American Plus" in front of "Phillips" on their orders for precision head screws

PLUSS Engineering Aid

American Screw Company engineers have had the longest experience with the coil-cutting, kiss-tinning opportunity provided by Phillips Head Screws. These engineers often can constructive aid in choosing even your assembly from old fashioned

PLUSS Quality Control

American Screw Company engineers are in charge of a well-equipped chemical and metallurgical laboratory. They constantly experiment and test new materials and manufacturing methods, so that you can expect 100% performance from American PLUSS Phillips Screws.

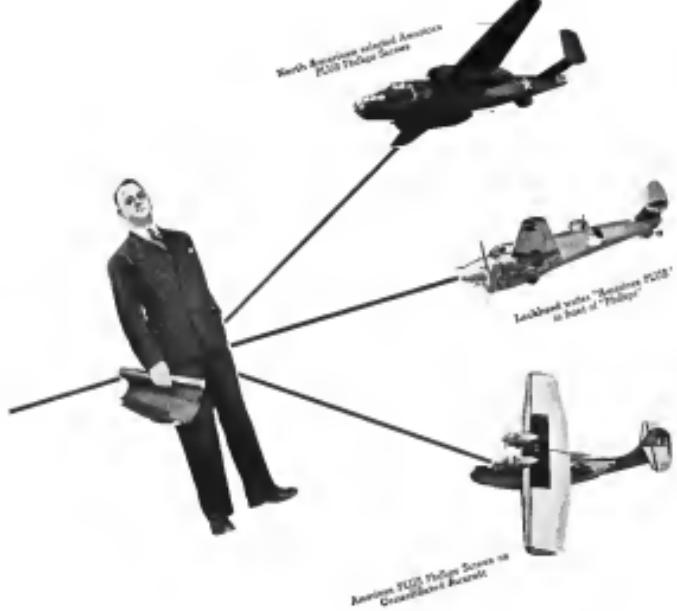
PLUSS Screw Inspection

American Screw Company engineers have established a system of plant inspection which insures high quality, full count on every shipment of American PLUSS Phillips Screws.

These three reasons—the "3 plusses"—explain why more of America's leaders write "American Plus" in front of "Phillips" on their orders for screws...and why more of America's will supply distributors handle American PLUSS Phillips Screws.

AMERICAN SCREW COMPANY

Providence, R. I.
Detroit, Mich.
1015 E. Grand Blvd.
1645 W. Hubbard St.
One Forty-Fifth Floor, 145 N. LaSalle Street, Chicago, Illinois
Other Domestic and Foreign Plants, Research and Trading



AMERICAN PRODUCED THE PLUS ...
THE PLUS IS PRODUCING FOR AMERICA



Tannewitz HIGH SPEED METAL CUTTING BAND SAWS

A Tannewitz Metal Cutting Band Saw
in the Machine Shop of the
Wright Aeroplane Corp.



Perfect, most efficient means of cutting off gullets and risers from castings of any metal. Models to handle magnesium and aluminum up to 38 inches thick, 52 inches wide. Larger capacity machines furnished on special order. Variable speed machines available. Write for Metal Cutting Band Saw Bulletin. You'll find the machine that's exactly suited to your needs—and that will repay its cost dozens of times in time and money saved.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN



Powered by Lycoming

In such planes as the Lycoming-powered Curtiss AT-9 America's military pilots are "stepping up" from Lycoming single-engine trainers to multi-engine pursuits and bombers—with assurance of that Lycoming dependability long established in primary training planes of both the U. S. Army and Navy.

For instance on engine for 50 to 100 h.p. have usually opposed or 60 to 300 h.p. radial engines. Westinghouse, Allis-Chalmers aircraft aircraft.

Contractor to the U. S. Army and Navy

LYCOMING DIVISION, THE AVIATION CORPORATION

THE TRAINING PLANE
ENGINE OF TODAY...
THE PRIVATE PLANE
ENGINE OF TOMORROW

WILLIAMSPORT, PA.

Our units batteries or battery carts
for engine starting, electrical testing —

Save with a Mallory Rectostarter

Compact, flexible, mobile, versatile... the weather-proof Mallory Portable Rectostarter provides dependable and safe DC power at minimum cost by the use of time-tested and proven Mallory Magnesium-Copper Sulfide Rectifiers. No batteries or battery carts to buy or maintain. You get quick engine starting or electrical testing... 24 hours a day, with no time wasted on recharging and the least possible maintenance expense. Write today for free bulletin that gives you complete specifications on various models of Mallory Rectostarters, both Portable and Stationary, for aircraft applications.

for Airplane Manufacturers

A Mallory Rectostarter supplies adequate DC power to run all aircraft electrical equipment... from 1 amp¹ gear² to prop... ...as many as three airplanes at one time! Both hot and remote control operation is available in eight sizes each, up to a 115 volt model plane rectostarter to handle all aircraft electrical power loads, drop lights or other single phase equipment requiring over 600 watts. And you can use a Rectostarter with other units with no gear lost.

for Engine Manufacturers

In engine installations, a Mallory Rectostarter can be utilized as an open circuit aircraft engine test stand... to start and test any DC motor driven equipment around the plant... for rapid charging 12 or 24 volt batteries... for ground air conditioning... for aircraft Rectostarter as proof against interior vibration and air turbulence. Rectostarter control insures safety... direct DC cable until the start button is pushed.

for Commercial Airlines

Rectostarter rugged and efficient is unaffected by temperatures ranging from -40° to 225° F. Portable or weather-proofed, it's built with DC voltage easily varied for fast and weather-secure aircraft electrical equipment, portable or fixed gear, etc., while an automatic variable unit is available to supply 12 volt DC cabin, bridge station, service engines. Rectostarters serve to improve charge plant efficiency rapidly and economically.

F. E. MALLORY & CO., Inc.
INDIANAPOLIS, INDIANA
Cable Address—PENALD



MALLORY

SERVES THE AVIATION, THE AVIATION-INSTRUMENT AND
THE AVIATION-COMMUNICATION FIELD WITH WELDING
TIPS, ELECTRICAL CONTACTS, SPECIAL ANODES, MAGNETS,
VIBRATORS, VIBRAPACERS, COMPRESSORS, ROTARY SWITCHES, SINGLE AND MULTIPLE
PUSH BUTTON SWITCHES, COMMUNICATIONS HARDWARE, RECTOSTARTERS

AVIATION, INSTRUMENT, INDUSTRY

North America's famous B-25 medium bomber covers 3,000 miles at a speed of over 400 miles per hour. Circle Sun to see pictures of planes in service.



TALKING NORTH AMERICAN LANGUAGE

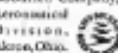
Men of defending planes, guns and crews talk the only language that would-be conquerors understand. And that's the language Uncle Sam is talking today. He's talking it with the world's finest aircraft, such as the North American Aviation Company's B-25 medium bomber shown here.

North America—and the other leading aerospace manufacturers—will not sit idly by to defend this country. Their production lines are now rolling, the machines that will keep Democracy alive.

We at B. F. Goodrich are proud to be of assistance to our nation's aircraft manufacturers. North America

is one of the largest users of B. F. Goodrich Aerospace Silverstowax, the silent surprise tire ever built. They also use our Bullet-Sealing Fuel Tanks... our famous De-tiers.

Today, more than 50 different B. F. Goodrich products are serving the industry on planes of all types. For information regarding any of them, write, by air-mail, to The B. F. Goodrich Company, Aerospace Division, Akron, Ohio.

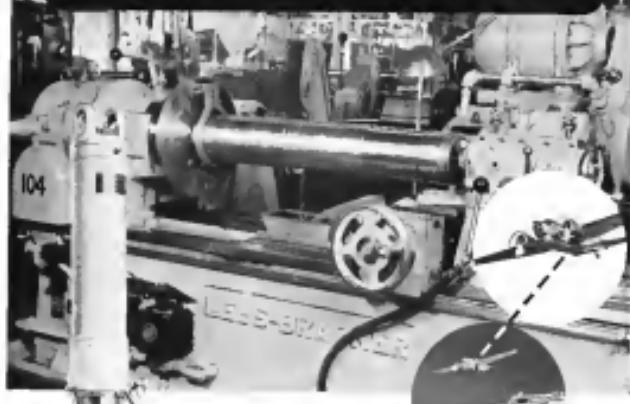


Fly with
Goodrich

FIRST IN RUBBER

MADE OF TIRE — TAIL ROPE — DRILL DRUM FUEL TANKS — AIRCRAFT INSTRUMENTS
DE-TIERS — MASTERS — SUPER SOFTS — DREDGES — THREE-ARMED GEAR

The Machine...the Part...and the Product



Precise landings begin with Precision landing-gear manufacture

This British Prince Charles Royal Navy, employing their art and skill to the maximum about the cockpit in preparation for landing, can only be the result of a string of safe and successful war-time operations.

From the moment the pilot's glances at his position-indicator tells him his wheels are down, until he has made his landing and taxied to a stop, it's relying implicitly upon the kind of precision workmanship pictured above.

Bendix Pneumohydraulic Shock Struts are built as carefully as a fine piece of furniture. For example, threads have to be held to truly close tolerances, and it must be remembered that these threads are cut in highly heat-treated steel. The photograph shows a 8-26 cylinder being thread-cutted in a large die. Look! Below:

BENDIX PRODUCTS DIVISION

OF BENDIX AVIATION CORPORATION • SOUTH BEND, INDIANA

Bendix LANDING-GEAR EQUIPMENT

AIRPLANE WHEELS AND BRAKES • PNEUMOHYDRAULIC SHOCK STRUTS
SWIVELABLE AND STEERABLE TAIL-KNUCKLES • PILOT SEATS

We Go to War

WHEN DAWN BROUGHT DEATH and destruction to our allied outpost at Pearl Harbor on December 7, the enemy made a serious strategic mistake on two counts. They attacked America to a minimum at the danger and they isolated widespread opposition against themselves. Their blunder blemished all the efforts of the Nazi technique when the British adopted all three of the British people by bombing Buckingham Palace. The Japanese action against us could have had only one purpose—to remove the obstacle represented by air and Pacific strength and repeat our fleet to the extent that the enemy would be left free to pursue their policy of expansion to the southward. In that they have made a miserable failure.

Our Navy has paid dearly in personnel and material for the Hiroshima Bombing and Our Secretary of the Navy has shown himself to be a man of action and has been quick to make adjustments in command. But more important than this procedure is the determination that we shall never be caught napping again. While the strag of the fool blow is still around us, we are in a bitter fighting mood. Japan has suffered as a great service in transforming naturally our love of peace into an urgent need for war—a process that would have taken a long time under any other circumstances. But neither the estimate of complacency nor that of fever heat is desirable from our standpoint. We must approach the peace task without laziness but with great determination to do a disagreeable duty quickly and efficiently as possible. When we have finished it this time, let us be sure to make it stick. And that is where the airplane comes into the picture, for it is the power that will keep order in the peace as well as war that we.

If there are any remaining doubts about the place of air power in warfare surface before December 7, that doubt has been dispelled by the actions against Pearl Harbor and the subsequent sinking of the unprepared Prince of Wales and Repulse off Malaya. Since the latter action we have heard no word from the formerly reliable advocates of completely independent air forces. We have now had sufficient evidence to show the proper place of air power in warfare. We have long since learned that an apparently the essential ingredient in successful military action. But it cannot be used to protect, support, and cooperate with marine operations as

well as in the offensive operations in which it has proved to be so effective.

Fortunately one aviation industry has reached the stage where replacement of our losses in the Pacific will be a matter of but a few days' production because of the progress we have made in the creation of manufacturing capacity during the past year. But we must look upon that accomplishment as only the beginning. We want double and triple the objectives until our striking power is so formidable that our air supremacy is far beyond question.

And while we are struggling with the greatest industrial project in all history we must somehow find time to look beyond the battle for existence. Our entry into war brings us still closer to the final peace and we cannot afford to be unprepared for peace as we were unprepared for war. At least one key lies in every aviation research organization should be assigned to the study of post-war planning and presented to have some degree of freedom from pressing immediate duties to think beyond the present conflict. Technological research, market and marketing studies, and new product development are ancillary parts of the job. Financial agencies should be set up to ease the transition from war to peace. Some of our more thoughtful manufacturers are doing some of these things already. They should do more and others should follow without delay.

Through the months and possibly years of war we must preserve our confidence in our armed forces and we must give them all of the support required to make them the instruments of victory. Aviation will assume its corporate identity with our military and naval establishments in the release of material for publication. We will second with their policies designed to prevent leakage of information valuable to the enemy. We will continue to give you the most authoritative news in early as it may be received in the interests of national security. To save valuable reading time we are offering for the first time in this issue a new format in which primary emphasis is placed on the manufacturing phases of the industry—research, design, engineering and production. It is our earnest desire that we will be able to publish more material of the type that will accelerate our progress in the inevitable victory.

John E. Dailey

AMERICA AT WAR

IN War with Japan, United States air forces must maneuver against the enemy over a 7,000-mile area with water underneath. This means distances far greater than any ever traversed by American fliers since World War I. Fortunately, the country's extensive production of long-range equipment when Britain emerged from the defense ring and called for distance expanders to go after Germany and Italy.

Reliability and durability of equipment will count for much, fortunately, U.S. aircraft and air transports have been evaluated on ruggedness and quality for years.

Points of defense and attack are not few but logically spaced, as islands and Arctic standoffs. The names chosen reflect navigation, in which both Army and Navy assist. Far American Airways' years of overseas experience have contributed much to the Service's staff in this art.

Fleet operations from a look at the map of the Pacific [bottom left] show that the bulk of the fighting ground is in Japan's zone of the war. But a cut perpendicular of their lands by Dutch and British and the United States has its Philippine bases, of profound though they are.

Here is a list of distances you will find useful, compiled for AVIATION by the National Geographic Society:

Miles
Mile

CHICAGO to TORONTO
1,465

CHICAGO to MONTREAL
1,470

DETROIT to JAPAN
1,490

DETROIT to CHINA
1,500

SINGAPORE to INDIA/FRANCE
1,510

DAVIS to SAN FRANCISCO
1,515

DAVIS to MIDWAY
1,520

MIAMI to HONOLULU
1,530

WALES to GERMANY
1,535

GUAM to TORONTO
1,540

ATLANTA to HONOLULU
1,545

PHOENIX to AUSTRALIA
1,550

PHOENIX to JAPAN
1,560

PHOENIX to CHINA
1,570

PHOENIX to INDIA
1,580

PHOENIX to FRANCE
1,590

PHOENIX to JAPAN
1,600

PHOENIX to CHINA
1,610

PHOENIX to INDIA
1,620

PHOENIX to FRANCE
1,630

PHOENIX to JAPAN
1,640

PHOENIX to CHINA
1,650

PHOENIX to INDIA
1,660

PHOENIX to FRANCE
1,670

PHOENIX to JAPAN
1,680

PHOENIX to CHINA
1,690

PHOENIX to INDIA
1,700

PHOENIX to FRANCE
1,710

PHOENIX to JAPAN
1,720

PHOENIX to CHINA
1,730

PHOENIX to INDIA
1,740

PHOENIX to FRANCE
1,750

PHOENIX to JAPAN
1,760

PHOENIX to CHINA
1,770

PHOENIX to INDIA
1,780

PHOENIX to FRANCE
1,790

PHOENIX to JAPAN
1,800

PHOENIX to CHINA
1,810

PHOENIX to INDIA
1,820

PHOENIX to FRANCE
1,830

PHOENIX to JAPAN
1,840

PHOENIX to CHINA
1,850

PHOENIX to INDIA
1,860

PHOENIX to FRANCE
1,870

PHOENIX to JAPAN
1,880

PHOENIX to CHINA
1,890

PHOENIX to INDIA
1,900

PHOENIX to FRANCE
1,910

PHOENIX to JAPAN
1,920

PHOENIX to CHINA
1,930

PHOENIX to INDIA
1,940

PHOENIX to FRANCE
1,950

PHOENIX to JAPAN
1,960

PHOENIX to CHINA
1,970

PHOENIX to INDIA
1,980

PHOENIX to FRANCE
1,990

PHOENIX to JAPAN
2,000

PHOENIX to CHINA
2,010

PHOENIX to INDIA
2,020

PHOENIX to FRANCE
2,030

PHOENIX to JAPAN
2,040

PHOENIX to CHINA
2,050

PHOENIX to INDIA
2,060

PHOENIX to FRANCE
2,070

PHOENIX to JAPAN
2,080

PHOENIX to CHINA
2,090

PHOENIX to INDIA
2,100

PHOENIX to FRANCE
2,110

PHOENIX to JAPAN
2,120

PHOENIX to CHINA
2,130

PHOENIX to INDIA
2,140

PHOENIX to FRANCE
2,150

PHOENIX to JAPAN
2,160

PHOENIX to CHINA
2,170

PHOENIX to INDIA
2,180

PHOENIX to FRANCE
2,190

In the far reaches of the Pacific, U.S. Naval aviators are wading in their last and westernmost states the Antilles of 1914. Our naval and carrier task force has one carry over 30 fighters and bombers.



PHOTO BY W.H.

The attack on Pearl Harbor began in a sun itself, exactly on the summit, according to a Japanese commentator in Germany. Some of the planes carried bombs and others torpedoes. The commentator said it was the first time the Japanese had used torpedoes.

Secrets of the Pearl Harbor attack is attributed in Washington to two major causes: audacity and vigor of the onslaught, and complete surprise, due to a feeling in the Navy

that the Gilberts or the Pescadores would not be approached, and due to the fact no patrols were made in Western seas, and diplomacy was not strict. Fortunately, the country's extensive production of long-range equipment when Britain emerged from the defense ring and called for distance expanders to go after Germany and Italy.

Army Air Forces officially report 20 Japanese airplanes shot down in the Pearl Harbor fight, and it cites several young and green pilots for spectacular victories. Navy Secretary Knox puts the Jay losses at 41. The difference is not accounted for.

The initial raid at which the Japs put Alfred wet traps out of the way, including two British battleships, was late yesterday. German fliers did not help expand and execute the strike. They did, they will survive, and that is regarded as ominous. However, Germany will have great difficulty in delivering many airplanes to Japan even if she has them to spare. And the Japanese are fierce, wise as it is, must grow more and more with time if the Allies ever shoot them down in a reasonable rate.

Putting Alfred wet traps out of action, the Japanese actually accomplished what the British did in their torpedo and air torpedo war—a never-poor-posed itself vulnerable to surface ships. In other words, if we are as vulnerable to an attack as central Pacific nations indicate, Japan is at a disadvantage against the surpassing power of the United States.

Again, as they have done in general, the admirals who make the judgments are trusting that heads can out the demonstrated fact, not the possibility, that their big weapons can be sent by plane. Home Naval Affairs Committee Chairman Carl Vinson announced that air harbors would be included in a new expansion program. This was regarded by some observers as the common beginning of the end of the surface navy. It was noted that harbors have been built in Asia that were not designed at once, after, and so on. It should be remembered, however, until the final official report is written, that the Japanese had harbors at Pearl Harbor as advance as planes.

The Japanese asserted that they had destroyed 300 American planes in Hawaii and the Philippines during the first two or three days of action. This is not about as tragic as quoted figure. U.S. Army and Navy said that losses were reported almost at once.

Most important of Pearl Harbor apparently was an air encounter at dawn mentioned in the next section. One plane disappeared in the dark action. 12 Boeing Fortresses (B-17) arrived in the midst of the raid, apparently because

they had not been warned to turn back. They were thousands of miles and out for a light. One of them was shot down, but the others drove around for refueling fields, and landed with only minor damage.

Our American Aviators announced that six ships and men on the Front are still "on board" and implied that operations are going on by saying that commercial freight and passengers are no longer accepted, leaving all the space for "cargo transport of arms and materials" needed in the East.

It is a fine game that FAAs could not operate on its rigs in San Francisco Masts rule while any one of us shipping stores stands it considerate unusable by many means. Pre-midday flights would be made on alternate routes, most likely by present line from Hawaii to New Zealand and on to Australia, via the Dutch East Indies and Manila. Or if that got too tough, you may suppose that all FAAs traffic could go the other way around the world, via Miami and Brazil to Limpopoville on the Congo, to Egypt, and thence, over sea or eight thousand miles of road to established, to Singapore and Manila.

Within 31 months of the attack on Pearl Harbor, the entire 20,000-mile Far American system had been reduced to a wire base under the long-reduced "Plan A." Their names sake and lights out, sweet schedules, and aging flight.

Ak-cause off with the loss of one ship and no loss. A K-44 gun-ship to Hong Kong just as no one to extend passenger and mail before a strong force of Japanese aircraft arrived and started down. They saw poor old "Merkle" and kept pouncing until they hit her squarely. At Wake Island, an old Martin 130 was put ready to make a patrol trip in response of the Navy commander there, before departing went mad, when a force of Japs came over. All their boats missed the Martin, but the took a spray of machine gun bullet, which did no harm.

Japanese seafarers however, as well as the Atlantic and South American, have been getting along all right between London and Lisbon, so far as I know. Indeed on the Faiscione front (immortal planes must get into very little trouble, apparently under a taunt

(Turn to page 19)



PHOTO BY W.H.



PHOTO BY W.H.

A series of photos below the war bases, with the Sarawak and the Tantang, two of our well-equipped carriers.



As the late Dak French left his aircraft factory to the many of his striking employees, he was pelted with stones thrown from the Paris mob.

French Lesson

A Study of the Industrial Demoralization that Led to the Fall of France.

By PAUL E. LAMARCHE

Formerly "Arrows" Correspondent in France

To many of our students the fall of France is still past history. But there were far less momentous events prior to the actual Nazi invasion last year and over two years ago. We were for us to press up the opportunity to point them this tragic example. And so we added the earlier war losses French, German, and American who travel through 12 pages of international developments in France to tell the story of the brief career of one of the greatest mistakes in modern history. My comments here can not stand in the way of the detailed history but have had full play of the drama of the fall of all French industry and the political process behind it. We have succeeded in showing that every leader of industry or government

France shocked the world.

To us it was a surprise. To some, including the writer, who had lived in France over a period of years, and studied political and social conditions there, the fall of France was not at all unexpected. Political, financial, and labor troubles plagued this highly industrialized defense industry during the years while the Germans were building a powerful war machine, rendered France virtually helpless in defense until. A lesson can be learned from the total mistakes that led to bitter defeat.

The spring of 1936 was the time for general strikes in France. War clouds long over Europe. The German had already occupied the Rhineland without resistance. This was regarded as serious. The Italians had completed the conquest of Ethiopia. For more than fifty years the French-Soviets had been the strongest party in French politics. The Left Center, a always but the greatest number of seats in the Chamber des Deputes. The vote of the masses is more numerous than that of the ruling classes. Left Wing groups have for years demanded expansion as

members of the masses. Socialists and Communists have always championed the workers. Working conditions in France have for years been lacking. Labor had some red and also some green grievances. Agents of both "arms" have always possessed a change in the social order in which we have lived for generations. Both "arms" appealed to the workers as being patriotic, and unscrupulous.

The results of the elections showed that France had adopted a Government of the Right. The Radical-Socialists, as Frere and throughout the world at that shock. The Socialist Party had increased its strength from 191 seats in 1936. The Radical-Socialists had dropped from 195 seats to 208 in the Chamber Communists, who would then had 16 seats, had 72. Parties of the Right and Center remained about the same. At the subsequent party in the French Government, the Radical-Socialists, and as a result, their leaders, M. Leon Blum, was asked to form a Government. This he did forming a government that included Socialists and Radical-Socialists, and Radical-Communists. This Government of the Left Socialist Premier of France was known as the *Front Populaire*, or Popular Front Government. Their leader, M. Leon Blum, was born June 1st of 1872. His family was born in Paris in 1872. As a lawyer, he participated in the celebrated Dreyfus case, and was elected to the Chamber in 1891. He has been a member of the Socialist Party since 1906. There are Frenchmen who will tell you that as a lawyer, his ideas have always been more conservative than conservative. A pacifist, he always favored disarmament. The set-up for a social revolution was complete. Socialists and Radical-

Communists were in complete disarray. The Communists were annoyed because they were left out of the Government.

There is an other stage of socialism. This is the right kind of socialism. Thousands of workers live there. Many of them are Communists. The regime is known as the Bell Bell of Paris. Paul Frere has often been expressed that the masses of this left held single day worth on Paris and overthrow the Government. But now France had a Government of the Bourgeois Left that was expected to champion their grievances and uphold a social revolution.

Helping to bring down the *Front Populaire* Government came into play that the workers illegally occupied factories and started an epidemic of sit-down strikes. The first factory to be so occupied was the Renault aircraft factory, where parasite manufacturers were being concentrated for the French Air Force. In no time, the metal works of Lavabine were occupied. The workers demanded a 40 hour week, higher wages, a closed shop, vacant workers day, and collective contracts. These demands were met in May of 1936 and served to attract the Government's attention. However, courageous strikers in pose gave every indication that a social revolt had started. At first the division refused to budge until the workers came out. They maintained that there was little difference between occupation of the factory by sit-downers and seizure of the employer's property. The police, under the command of General Gamelin, did not interfere with the strikers. The Government did not overlook M. Salengro, Minister of Justice at the time, claimed that force would not be employed against the striking classes. Employers held out for a while argued against the Right of any strike action, but unable to obtain any satisfaction from the government, and believing some strike against them, yielded to demands. The workers were immediately given closed factories with pay in order to reassure their families. All agreed, however, to give vacation with pay, a 40-hour week, in spite of the fact that the 40-hour week had been effective since 1918, and to allow collective bargaining. The fact that a 40-hour week would be disastrous in either by the owners or the labor unions or the *Front Populaire* Government. In addition, however, it was agreed that the 40-hour week would not increase the purchasing power of the masses, and that it would reduce production and thereby raise comparative prices. They maintained the buying of the vacation week. Then began an era of destructive policies that lasted for two years while Germany prepared.

The in-down strikes were organized

by the *Confederation Generale de Travail*, better known as the CGT, of which by M. Louis Jouhaux was the leader. Some of the strikes were successful, and some in defiance of CGT orders. There were later the order committed with them. Pickets at the gates allowed the mass of workers to bring in food. Non-employees were not allowed out. Agitators came and went. In some instances foremen and even shop managers were forced to stay in by the workers.

The CGT was a new idea or organization of the *Front Populaire*. It had existed much before the last war as a Federation of French Trade

Unions. M. Louis Jouhaux, whom some Frenchmen will tell you started the CGT as a union organizer became leader of the Federation in 1919 following a disastrous strike in which the French Army was the victor. This strike, a 40-hour week in mathematics occurred during the war of 1914-1918, as well as new formulas of relations of unions. In 1920 the CGT, anticipated a General Strike, in which the Government replied by sending their bulldozers and demolishing it. There was no strike. The CGT suffered much loss of life.

But to come back in 1936, the CGT was again a powerful Federation of

(Turn to page 28)



Below: After demanding a 40-hour week and receiving it, these workers demonstrated and staged an additional sit-down strike on the roof of a Renault plant. The Germans were soon there working a 60-hour week.



Aviation in Brazil Shows Active Progress

After spending three months in Brazil, Alice Hager discovers new activities on all aviation fronts. This is the first of two articles.

By ALICE HAGERS HAGER

Photo by Leslie Meeks

BRAZIL is one of the best and greatest of the world's frontiers. In its potential natural resources it is unequalled by any country, but it is also one of the most difficult of all to move from the stranglehold of transportation. There are at present more than 37,000 miles of navigable rivers, 2,500 miles of railroad, and good old roads are being extended here and there in many areas. But in innumerable almost inaccessible areas, the Amazon down through Goias and into a large part of the Mato Grosso,

has almost no surface transport of even the most primitive type.

The reasons are both geographic and economic. The total length roads and railroads through the jungle would be astronomical—for beyond Brazil's present ability to pay, even if they were necessary. Railroads are being built and the older ones are being stretched farther and farther into the interior, but they are not the answer to the country's future.

The answer is to be found in aviation and Brazil is thoroughly aware of it. Under President Vargas, it is rapidly becoming one of the most important factors in the Hemisphere. There is naturally a reason or two that you might consider this does not have an Aero Club. The club may still have no planes, but it is always working to get them and it always has a large and enthusiastic membership. Vapors and landing fields are growing constantly in number and there have been three major surface extensions to the interior since the last war.

In January, 1938, Vargas established the Air Ministry, and control of aviation came under this one head. The Naval and Army air arms were transferred to the Ministry and are rapidly being welded into a single Air

Force. The Department of Civil Aviation was made another branch and the Brazilian government is the Air Mail carrier. The Air Clubs are now organized through an office in Rio, which has a Military Division, appointed by the President, and the civil pilot training, done within the club structure, is under Air Force supervision. In that way, the entire aviation system is being integrated for unified action.

One of the most important contributions to its growth, however, is not new. The Society for Rail Service, organized in 1930, in the rail passes in the interior, has been instrumental in getting more pilots in experience and knowledge of terrain, and by the President as a means of communication with isolated regions, it has gone into practically all the mining districts. In many locations, the road has been the bone for further airline development.

Aircraft manufacturing is still in its infancy. The large plant, on an island in the Rio Paranaíba, established by the late Henrique Lage, president of the Belo Horizonte Engineering Company, during external times, is still small and fairly circumscribed. At present work is concentrated on two planes, the Maran, of the M-7 and M-8 types, both military trainers, and the new Haka, which is a

Timeline machine at work on a Fokker-Wolff in the Getúlio Air Force factory.



Commercial Air Arms of Brazil, as of April, 1938, are as follows:

1. **ESTADO DE V. A. E. S. GRANDE—**Port Moresby to Asuncion via São Paulo, Porto Alegre, Rio de Janeiro.
2. **SHOCARATO CONCEPÇÃO GEMITADA—**São Joaquim to Petrópolis, Rio de Janeiro-Brasília, Araras, São Paulo-Goiânia, São Paulo, Araras via Tocantins, São Paulo-Kayapó, Rio de Janeiro-Lagoa Verde, São Paulo-Tocantins.
3. **FABRICA DE PISTOLAS—**Ponta Alvorada, Rio Pará via road and Amazon river, Rio da Impenetrável, Manaus, Rio Negro-Pé da Colina-Pé da Istrada, Rio Manaus-Cheia, R. Manaus-Cheia-Pé da Colina, R. Manaus-Cheia-Pé da Istrada-Pé da Colina.
4. **PRODUTORA DE AVIAOES—**Rio de Janeiro, Rio de Janeiro-São Paulo-Distrito Federal.
5. **AMERICAN AIRWAYS INC.—**Rio de Janeiro.
6. **BRASILIAN AIRWAYS LTD—**Rio de Janeiro.
7. **AVIAOES DO BRASIL—**Rio de Janeiro.
8. **ALTA LINHA—**Rio de Janeiro.
9. **TACNA S. A.—**Rio de Janeiro via Amazonas.



Front view of the modern-designed club house of the São Paulo Aero Club.



Tom Souza, who designed and built the T-34a, shown here. Souza believes this plane has improvements over.



Major John Amerson da Nóbrega, Commandant of São Paulo Aer Club. Souza is vice president of the Aero Club which has 100 members.



Col. Antônio Ayrosa Nóbrega, Commandant of the São Paulo Aer Club, and former commandant of the Royal Air Force. He spent two years in Paracatu, and holds 100 licenses in the Brazilian Air Force.

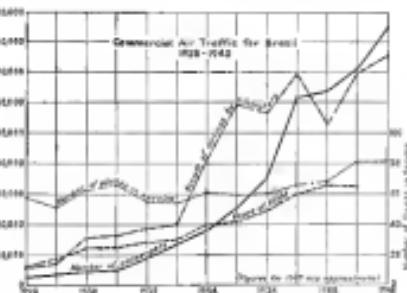


Based on Oct. 1, of the engineering service of the Brazilian Air Force, consisting a 380-hp Gipsy Major engine recently received from England. Aircraft is a Miles M-17 Brazilian designed military trainer.

Night trainer for civilian use. Vargas has ordered the production of 250 of these H-Lo for the Aero Club.

At the Air Force Base on Ilha Governador, also located on the Rio harbor, is a government factory for military production. This is one of the most prominent in Brazil so far as plant is concerned. The buildings are excellent, at modern engineering standards. A separate building on the Ilha Wolf contains modern bombers and the Fábrica Wolf Straight bombers, under Getúlio Vargas, is now going on. The first of Brazil's aircrafts of this type was given its trial in July and proved satisfactory. A mechanic training school is located at the base and also a school for apprentices, from 14 to 17 years, entitled Universo. The factory is working under considerable difficulties since it has a very limited supply of machinery, mainly German and Japanese, and so far has had trouble to get more.

(Please turn to page 14)





FLYING EQUIPMENT

Vought-Sikorsky Flying Boat

In a world at war, launching of American Export Airlines' passenger boat strikes a hopeful note for future of air transport. First complete story of the new Vought-Sikorsky flying boat VS-44-A

By CLINTON B. F. MACAULEY,
Associate Editor, "Aviation"



New compartment: looking down into the swimming bath. Below: of democracy through first boats built by men on ships. Note distinctive feature of two doors, one to left stairs, and one to right of photo; lesson used to existence hydrations. Below: same compartment looking forward.

GEORGE I. SIKORSKY and the entire staff of the Vought-Sikorsky, Inc., General Manager McCauley and the rest of the team of engineers and workers in formers and chasses, have survived amazingly the past year and have now brought forth a giant flying boat which bids fair to challenge all classes on the Maritimes aerial trade routes of the North Atlantic for some time to come.

Dipping its sleek hull into the waters of the Housatonic River, United Aircraft's Vought-Sikorsky Division, located at Stratford, Connecticut, the VS-44, flying boat, was the only flying boat ever to carry passengers, and it can transport loads over long ocean-water routes. It may be expected to carry forty passengers on daytime flights a distance of 3,000 miles at a cruising speed of 200 m.p.h. However, for nonstop transatlantic service, it is equipped with sleeping accommodations for sixteen passengers in addition to the crew, and will cruise at approximately 175 m.p.h. Maximum landing range, under

going toward completion, she will be delivered to American Export Airlines at a cost of \$2,700,000. The Vought-Sikorsky engineers have remained freely with technicians of American Export at every stage of design and construction to avoid shortcomings evolved out of over three years' experimental operation of Export's Consolidated PBY.

The passenger characteristics predicted by her builders will certainly make the VS-44 the fastest flying boat in the world and a flying vehicle capable of carrying passengers, and cargo, across oceans, in record-breaking flights over long ocean-water routes.

It may be expected to carry forty passengers on daytime flights a distance of 3,000 miles at a cruising speed of 200 m.p.h. However, for nonstop transatlantic service, it is equipped with sleeping accommodations for sixteen passengers in addition to the crew, and will cruise at approximately 175 m.p.h. Maximum landing range, under

Below: looking off in the rear main bulkhead. On the right looking forward; to the main bulkhead. Hatchings can be seen in place to isolate water remaining after storms with ice come numbers. By means of articulated fittings these plates support the front



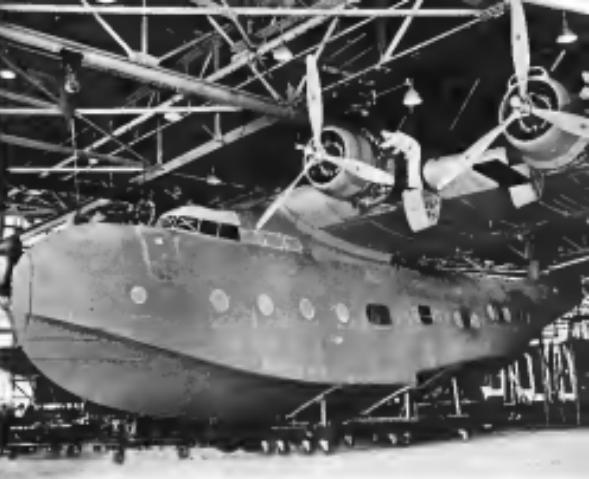
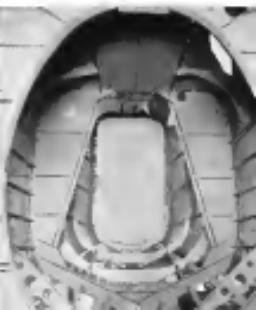
special fuel load condition, is in excess of 6,000 miles.

Swimming Bath

The 80-ft. hull is beautifully streamlined. Of submarine ship hull-monocoque design, it is designed for maximum efficiency in taking a load and never breaking up in the water, with a maximum of drag in flight. The wider part of the hull is along the life-rafts deck to the first step. From there it tapers in to the upper deck.

Right: shown method of laying hatchings edge of wing into top of hull. Below: showing how hatchings are laid out on one step showing bottom of hull.

and rear bulkheads of the wing. The flexible attachment prevents transmission to the hull of undue local stresses in the wing area, such as might be encountered during violent re-landing in heavy seas.



which runs the full length of the ship. A small keelson is continuous along the bottom of the hull all the way back to the stern deck, just forward of the till surfaces, except between the two main bulkheads, where the shallow cross-braces require additional strength in the keel. Here between the bulkheads connecting with the deck and rear spar of the wing, runs a full keel, an 18-inch approximately 1/8 foot in depth.

The bulkheads vary in spacing from about six to seven feet. Between these are the frames which have deep notches between the bilge-chines and bottom and walls applied to the top of the hull. These are spaced at an average of 24 inches. As in boat construction, frames reinforce the stresses at junctions with bulkheads and frames.

Stringers are continuous between bulkheads. The stringers on the bottom of the hull vary from 1 1/2 to 2 1/2 inches in diameter and are spaced 34 inches apart. Spacing varies elsewhere on the hull, depending on local stresses.

The dead skin at supported by the angles of the frames, bulkheads and stringers. The thickness averages from .52 to .040 inches, but locally it ranges all the way from .06 down to .025, where stresses are low. The sheet metal applied to the bulkheads and frames is usually about .028 inches thick, increasing toward nose up to 1/8 inch thick.

The hull is arranged as follows: a motor compartment in the bow where auxiliary, tools, and emergency gear are stored; forward cargo compartments; galley and crew quarters with flight deck immediately above the four main passenger compartments; aft main passenger compartments; all crew accommodations; and stern cargo compartments.

The hull is arranged roughly as bulkheads. An interesting feature is the manner in which bilge sections of the floor can be raised to form watertight decks between flooded compartments. Should the bottom strike a floating object and flood a compartment, the water would rise approximately only halfway up the entire. For this reason, the floor does extend only a short distance above the flood line. It is thus impossible for personnel to get trapped in a partially flooded compartment. The hull is so designed that any two compartments can be so flooded and the ship remain on a reasonably level keel.

Wing and Hull Structure

The 124-ft. wing is full cantilever type consisting of a center section and two outward panels. The center section is built around two shear webs with transom ribs and arched skin. It supports the engines and has three separate built-in compartments to carry approximately 4,000 gallons of fuel. Between



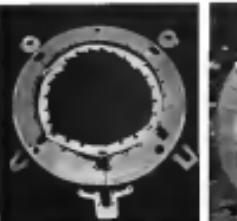
Interior assembly of outer wing panel showing the spar and all shear webs connected with transom ribs. Gutar plates are utilized in center section with four barge pins.



Construction progresses on a carrier wing section with four nacelle mounts in place. The four main tanks are built into the inner section. Operative status gives access to solid sheet surge space in wing.



Detail figures along the trailing edge of the trailing edge flap system around its track by a low servo when flaps are in down position or not fully retracted. They would help even serious damage if flaps were to break quickly enough in a rough wave location.



The deckhouse assembly on the left needs the cylinder and solenoid mounted at the center of the hatch. The remaining hatch covers are rectangular and are also mounted in rectangular rubber sections, the top has a slight movement. Above in photo on the right there have been no greater record rates of displacement on a 43-degree Boeing 707 with similar design required a moving hinged on the central support ring.



the center tank and the aftward tanks, space is available for baggage, mail, or additional fuel tanks.

The wing section required in the NASA 2,000, tapering in thickness from 1/8 percent of the chord at the root to 9 percent of the chord at the tip. This wing section was selected because it enables efficient lift and drag characteristics with small center of pressure rates.

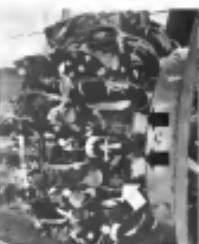
The outer panels are of essentially the same type of construction and are relatively obtainable from the market by removing fine bargepins. The entire wing is metal covered on the outer house. Covering on the leading edges and solenoids is fire-proofed fabric.

One of the most interesting features of the wing is the method of attachment to the hull. By means of four flexible straps the front and rear beams are situated in either side of the two main bulkheads. Thus, certain local stresses of high wind from the trailing spar are not transmitted to the bulkheads.

A series of articulated "flaps" along the trailing edge of the trailing edge flap constitute another unusual feature. On either side four segments, extending down a post just above the large chain fairleads will open outward, are so mounted that they will spring upward if struck by a low wave in the down position. Of course, normal procedures for landing would still allow the craft to land on the water, but the flaps would help to prevent serious damage if, unfortunately, the flaps were not raised quickly enough.

The flat surfaces are of full cantilever construction, structurally similar to the wing. The fin and rudder are metal cased, while the rudder and stabilizer.

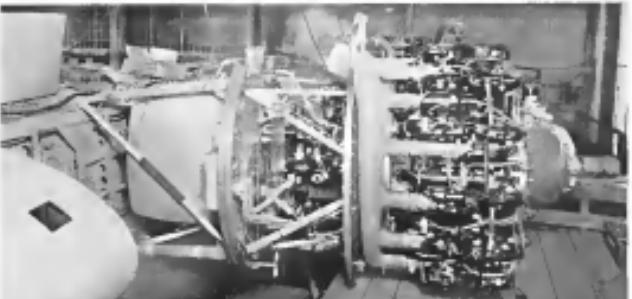
(Turn to page 192)



Bottom view of frame two of the "bow" which contains the vibration of the 1000 lb. Pratt & Whitney engine in a separate cabin.

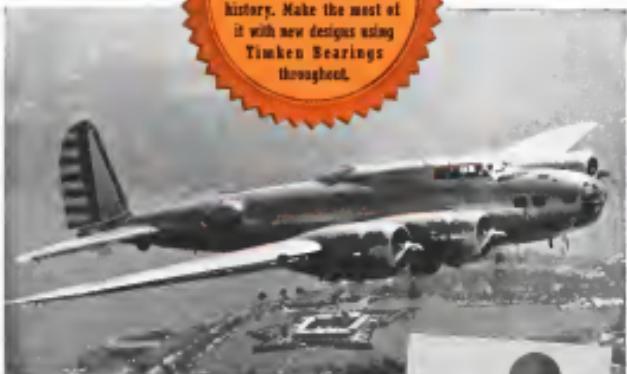


Both struts are oriented like those components, suspended by two struts. Engine and engine mounted in the first secondary compartment in the middle and oil tank in the rear. Quick-disconnection plug at sternpost and plain-hinged engine mount supports allowing engine movement.



LOOK AHEAD!

After defense—the greatest opportunity in airplane history. Make the most of it with new designs using Timken Bearings throughout.



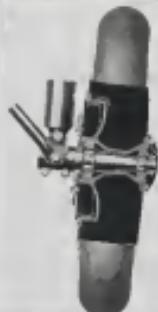
American military airplanes like this Boeing "Flying Fortress" are playing a vital part in the defense of liberty and democracy on all fighting fronts. Timken Tapered Roller Bearings and Timken Steel in landing wheels, engine rocker arms and other important places help to give them the superior performance, dependability and endurance for which they are famous.

Future airplane production will emphasize commercial rather than military ships, but Timken Bearings will continue to have an important influence on operations—and thus on sales.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN
TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for commercial, marine, mining, railroad cars and locomotives and all kinds of industrial applications. Timken Alloy Brakes are made from the finest American Tinplate and Timken Rock Wool.



Typical application of Timken Bearings in airplane landing wheels. Timken Bearing Equipped wheel arms furnish far heavier and more straightforward landing gear than steerable or telescopic arm methods, and are exceedingly strong.

AVIATION Manufacturing

PRODUCTION • DESIGN • RESEARCH • ENGINEERING



INDEX

Building the Consolidated P-34	By Major R. H. Fleet	61
From Seat to Seat in Eight Hours	By James Morris	70
Interiors Step Up Production	74	
Ball-Bar Assembly of Air-Cooled Motors	75	
Wood-Plastic Airplane Parts	77	
X-Ray Inspection and Supplementary Techniques	81	
Helicopters of Tomorrow	84	
Recyclium Alloy in Aviation	88	
Aircraft Hydraulic Pumps	92	
By E. Banks Wilford	92	
By Dean Lester J. New and		
Edward M. Grier	96	
Aviation's Sketchbook of Design Details	98	
Engineering News	100	
New Products in Aviation Products	104	
Motorized Skating	107	
Chicago and Southern's New Base	110	
New Equipment for the Aviation Industry	117	

Building the B-24

The war may be won with heavy bombers. Both the U. S. and Britain are counting heavily on the long-range Consolidated B-24's. Here is Major Fleet's own story of the building of this famous airplane.

By MAJOR R. H. FLEET,
President, Consolidated Aircraft Corporation

AMERICA is committed to the job of beating the three Axis powers. This will be a tough job. The only possible way to do it is with big bombers. That's where we come in. We have developed better and bigger bombers in the United States than in any other country at the world. And we have the capacity to mass produce anything that can be built by industry at a rate surpassing any other manufacturer of armaments in the world.

We have beaten the rest of the world put together in producing big planes. Now that we must produce for war, we know that we can beat the world in that field too. Just as America has made, sold, and used automobiles, more radios, more electric refrigerators, stoves, vacuum cleaners, telephones, and

many other machine-made articles on a scale exceeding all the rest of the world combined, so we are now building a heavier bomber program that has no precedent in history.

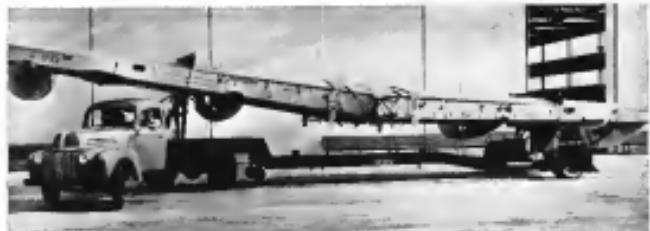
Before the war began American aircraft designers and military experts were divided by Axis and anti-Axis officials as to their preoccupation with the development of very large bombing planes. We led the world in production and use of large transport planes, and, as far as our great land and water distances, we naturally thought of the use of large bombers.

Now that the war has burst at Europe's borders and becomes truly worldwide in scope a new appreciation of the effectiveness of air power has developed.

With it has come the realization that

the key to control of the air is the long range bomber which can strike with great power at great distances. Data this nation America is able to project superior designs of large long range bombers, of better performance than any in the world. And with our national currency for mass production of aircraft, and long trips to bombers we will build these planes at a pace which should soon bring to the Democracy the power to strike effectively anywhere in the world. Before we are through with the present long range bombing wings leaders use current model Consolidated B-24 four engine bomber, and over the Douglas B-19, will probably seem small for comparison.

America's bomber program, and the aircraft industry will lead Hitler and the Japs as exemplified by the tremendous production program which has been conducted by Consolidated Aircraft Corp., and which is now proceeding at an ever growing rate. The expansion of production and facilities by Consolidated is probably as all-time record for any aircraft plant, let it be noted who has been happening throughout the entire country. With seven major facilities of factory size, and one under construction in the San Diego area there are some 10,000, not to mention an additional two sets of panel and riveted part areas used the year round for final assembly work, the Consolidated productive expansion seems almost magical in the atmosphere and simplicity with which it has been achieved. The main



A B-24 wing section rests on a specialized truck and trailer.



A giant sheet of steel assembly work is done in the period open space of this factory. Because of the size of this brother, many men are used to lift without rubbing others.



The mighty B-24 which "will prove to be the 'biggest' in history" is here to win us the war. See the demonstration.

set of machinery surrounds the large assembly plants soon to go into operation at Fort Worth and Tulsa, and the great Ford parts fabrication plant in Epiphany, Mich. Not a floor area is by any means the whole story. We have added a tremendous quantity of machine tools to our San Diego plant and have greatly exceeded the pay roll.

How we have reached as high a level of production as is possible, while at the same time of the greatest production program, is not easily told in a few words. There are a number of keys to the situation. Most important is the fact that Consolidated is a "big airplane" company. We have always built big airplanes and in so we have thought big, planned big, and built big in the way of factory and equipment. Our example of this logic is that Consolidated is unique among American aircraft plants for its size of personnel for feasibility and installation work. Our final assembly yard literally includes the "whole outdoors". We have more

than 50 acres of yard area which is specially paved, drained, and fitted with electric, ice and water outlets for production work. The climate of San Diego is such that it is practicable to use this production area throughout the entire year.

Nevertheless, there is more to this problem of production than just having plenty of room in which to work, which is indeed a valuable asset. Consolidated has always favored the fact that its executive staff has been composed of old-timers in the aviation business, many of whom served through the greatest days of the first World War. Our men are old enough to have acquired the all essential "know-how", but production practical production short cuts get off young enough to have the drive that puts things done. There is certainly no simple formula for solving the production problem, which we have all had to face in connection with the ever-growing national defense program. The only formula we have been able to standard-

ize for Consolidated is to combine practical experience with mental effort, and then double that in lag work, invent and sleepless nights.

We believe that our organization has been blessed with unusual foresight and executive daring. This is reflected by the study of how Consolidated became one of the largest producers of record during the early days of aircraft production when it transferred, in 1935, from Buffalo, N. Y., to San Diego, Calif., a distance of about 2,000 miles. This move long-range vision and daring was evolved in the bold expansion plans initiated by Consolidated late in 1939, when the growing world crisis made it untenable that aircraft production would have to be greatly increased. Ahead of government orders, and also ahead of the production of Consolidated, we have more than 100,000,000 worth of machine tools and equipment and art about to quadruple the size of our San Diego plant. This first expansion program has since been doubled and redoubled by the government's heavier production schedule, which now includes the Fort Worth assembly plant, to be operated by Douglas, the Tulsa plant, to be run by Boeing, and the Epiphany plant to be run by Ford. But the most remarkable and unique expansion program has carried on through and over many of the problems which later developed.

No amount of planning produces results unless it is backed up with money, machines, and men. Consolidated was fortunate in the field of financing its expansion effort. At the very start of our building program we were bolstered by a strong current financial position and an excellent record, making it relatively easy to raise the money. Advances on large foreign orders soon became available to bridge the gap to government allocations for future construction and equipment. There has

never been a moment's delay for lack of money.

As outlined earlier, the problem of obtaining machines and equipment was greatly simplified by the fact that we placed our big orders early in the game. Furthermore, we had already had several years' experience in building large numbers of big planes and so were in position to speed up procurement needed in view of our experience.

It might be thought that the personnel problem would be more difficult, especially as Consolidated is located at a semi-industrial area which was rather sparsely populated until recently. The nearest metropolitan center is Los Angeles, more than 125 miles away, and the heavy flying programs of aircraft companies in that vicinity made it impossible to obtain the kind of personnel that is very rare. But by advertising our employment opportunities to local men from other parts of the country we have been able to multiply our pay roll more than 150% in less than 24 hours, and without competing with other aircraft plants. This was done in two ways; first, by organizing a staff of trained personnel men who went out to industrial centers of the area and midwest and to leading technical schools, or being on available men as recruited. Then we established a recruiting and training program, both in our own plant and in collaboration with the city and county of San Diego, so that available qualified help could be trained to meet our employment requirements.

Of very great help in our hiring program has been the element of incentive which surrounds the construction of big planes which hop the oceans and girdle the globe in repeated round-the-world flights. Our men have been attracted by the desire to be associated with the building of really big planes. They have given full credit with the performance of the Consolidated PB4Y's through the many newspaper stories telling of the non-stop ocean delivery flights staged with these planes by the U. S. Navy. And they all take pride in the daily reports of new long range performances of the newer B-24's as well as the PB4Y's.

Prior to completion of the B-24 we had over 200 PB4Y flying boats make the Pacific hop to Hawaii without a single mishap, setting records above record for reliability and speed. We had started in the trans-continental trips of PB4Y long, the longest over-the-line flights of flying boats, the non-Stop Polar flight by Sir Hubert Wilkins, the round-the-world flight of Arnold's "Gull," and many other notable PB4Y performances.

Now increasing loads have been brought in. Consolidated is the B-24, which is daily ferry service across the North Atlantic and which holds the



When parts for the B-24 are finished in the sub-assembly department they are hung from the ceiling until final assembly crews are ready for them.

non-stop trans-Atlantic speed record of less than 8 hrs. The list of records which have been broken by the Atlantics, B-24's (or "Liberators" as the British call them), many of them built here, continues to lengthen as full, but amateurish U. S. Airmasters to Great Britain, G. G. Wherry, Lord Beaverbrook, Viscount Hinckley, W. McDonald King, the Duke of Kent, and many others. Recent notable B-24 flights have included a record daylight hop of 3,000 miles across the South Atlantic; a round-trip from San Diego to Hawaii in 25 hrs and a record flight from San Diego to India, the first by a U. S. Air Force unit.

All of these flights have helped attract us to our production shops, and have helped to establish pride in the men already working while these planes are built.

Some conception of the expansion of

Consolidated's pig wall with respect to the towns in which we are located is gained from the fact that one out of every five Zaporozhets, the planes developed by Consolidated, was the property of the town and has doubled in the past 12 months. Sand grooves have naturally brought with it problems inside the plant as well as outside and we have had to give attention to the many phases of community planning. Mass importance has been placed on adequate housing. One project alone, built exclusively for Consolidated employees, covers an area of over 10,000 acres and provides houses for more than 15,000 people.

An airplane which justifies such a

huge fully retractable Fowler wing flap. These flaps, together with the tricycle landing gear, make a practicable inoperative undercarriage assembly of loads which might not normally be considered adequate. Construction of the B-24 is almost throughout, including almost smooth skin covering of wing and fuselage.

B-24 Production

The story of B-24 production revolves around design, construction and planning into production of the large new buildings recently completed at San Diego, which were constructed on the principle that the shortest distance between two finished buildings is the road which connects them by means of straight line. Raw materials flow into

one end of this mile-long defense plant and completed sub-assemblies move from the other. From down all sub-assemblies travel over a road in the form of a loop, two which might not normally be considered adequate. Construction of the B-24 is almost throughout, including almost smooth skin covering of wing and fuselage.

B-24 Production

All our new buildings were built on filled ground and presented special foundation problems. More than 3,000 steel piles were driven and 100,000 cubic yards of fill were required. Two steel buildings are provided with sheet membranes running out over the railroad tracks and loading docks which parallel the entire length of all buildings. A continuous membrane extends along the full length of the loading dock, covering all buildings. Massive bridges connect all of the main buildings across the wide spaces which separate them, so that all parts of the plant and loading dock are interconnected by the most direct route. Total cost of the plant and buildings is believed to constitute the largest such installation in the world, a total of \$64 million.

Production flows through all of the main buildings, being facilitated by full width barge-type doors on the ends of all buildings. All sub-assemblies leaving the end of the plant pass over by truck over the paved road to load assembly in another plant. Parts and materials come along the track of all our buildings and are stored in the various sheds and loading docks. The warehouse building funds material to all buildings by means of the material system or by truck moving along the railroad platforms. This platform is also used for all truck deliveries via the highways.

A 20 ft. space extending off along the complete length of the outside of all of the buildings provides ample storage space for parts and materials. The storage areas and materials are fed out onto the various sheds and depots for fabrication, processing and assembly. Much of this work, along with inspection, is done on the double-deck material which extend the full length of all buildings. The maximum people on shop floors for usual machine operations, besides work and light office-work, is 1,000.

Workshop floors, as shown in plan, are given over to the machine shop. Approximately 600 machine tools are in the one building, and there 3,000 precision machine in the engine factory. Blasting presses are also located here for cutting off sheet stock to shape. Many mass assembly jigs are also located in Building 2.

(Turn to page 237)



Scoring 400 women help build Consolidated's long wings. These are working on standard assembled parts. Others do a variety of sub-assembly work. All women wear blue checkered aprons.



Giving the run in the sky as the job of the formidable bombers. With a reported speed of over 300 m.p.h. and a 3,000 mile range, the B-24 is a buster that means business.

From Print To Part In Eight Hours

Development of Kirksite dies for punch press work is saving time and money in production at Vega.

By JAMES HARRIS,
Foreman, Hammer Foundry and Press Department,
Vega Airplane Company

AIRCRAFT sheet metal forming processes have progressed through a number of stages as production quantities have increased. We originally formed aluminum sheet parts by hand bending over a hardened form. Larger production brought the development of the drop hammer with its own heat and dies. With the introduction of Kirksite dies, we moved into the third stage.

The dies we used in the first two stages were with a rubber pad underneath, or one die and various materials, including steel anvil, and raw living wood for the other. Now that we have entered quantity production of aircraft parts, press work, so widely used in the same aircraft industry, is being adapted to meet aircraft production work.

One drawback of the punch press has been the cost of dies and dies removal, and the length of time needed to make these dies. Now we have found a possible to employ cast Kirksite dies for

punch press forming and possible savings are being realized. Not only do we reduce the cost of making the dies, and speed up the process, but also let the lower the costs since it's possible to shift more operations from the drop hammer to the punch press and so accomplish a substantial saving in production time.

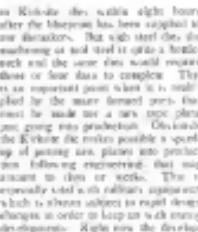
We now have developed the first 12 cast Kirksite dies which we have made for punch press work required an average of 30 man-hours per die, as compared with a previous labor rate of 100 man-hours in making and tool dies. The time reduction will be even marked in the future as we perfect our technique of making these cast dies for punch press work. A further saving can be made in the cost of dies if die production runs from the time the part blueprint is available until the part is in production. We find it possible to start production on punch press parts made



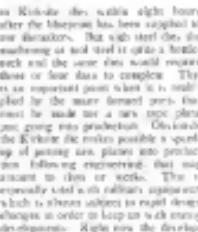
1. This step is making a Kirksite die stock with a blueprint of aircraft metal being part F. Metal prints out details to front. Clockwise: Time 8 min.



2. Next is placing prints on stock from which a sand mold will be formed. Here Frank Orman is running punch patterns by template. Time 8 min.



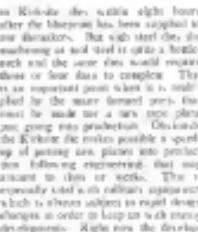
3. At next run, diecast is pressed low after mold. Very little machining is required following the casting process. When die is no longer needed, the casting die is reused.



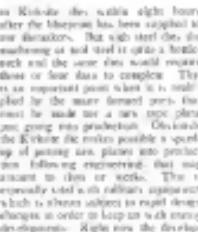
4. After 8 hrs in casting process, the Kirksite die is shaped on a Gruendt & Welsbach shaper. The die will then be ready for use in a press.



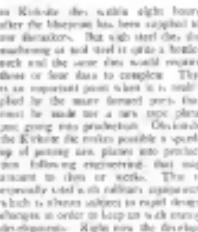
5. At next run, diecast is pressed low after mold. Very little machining is required following the casting process. When die is no longer needed, the casting die is reused.



6. After 8 hrs in casting process, the Kirksite die is shaped on a Gruendt & Welsbach shaper. The die will then be ready for use in a press.



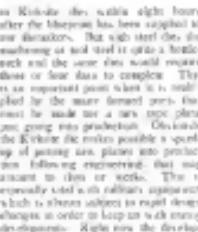
7. Setting the die in Blue M Press Frame. It is the first operation of the new Kirksite die as usually stamped in with Armstrong press head clamp.



8. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



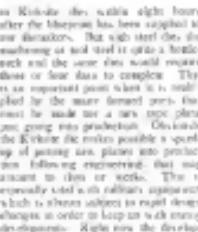
9. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



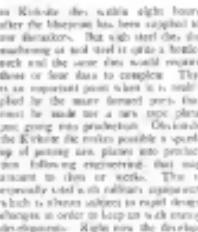
10. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



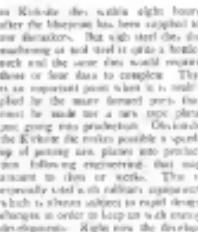
11. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



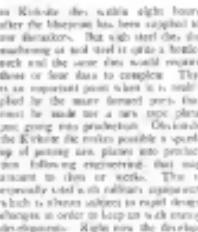
12. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



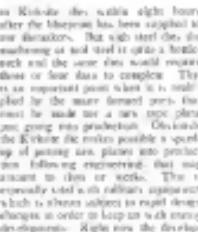
13. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



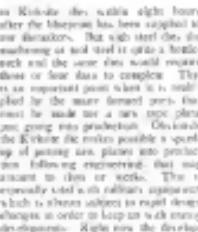
14. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



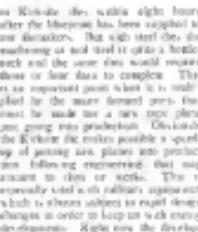
15. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



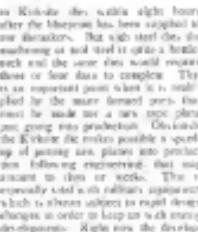
16. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



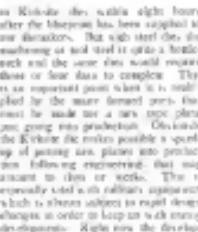
17. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



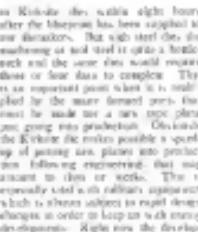
18. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



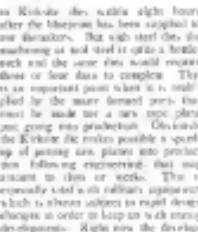
19. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



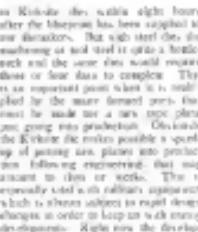
20. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



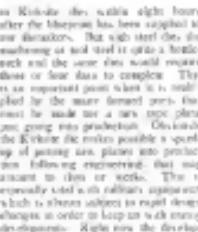
21. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



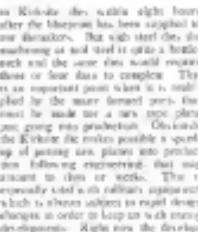
22. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



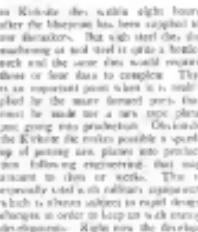
23. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



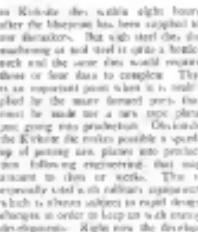
24. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



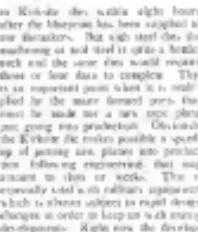
25. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



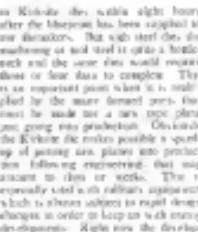
26. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



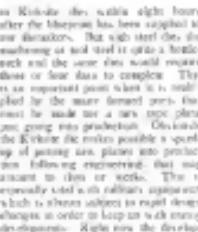
27. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



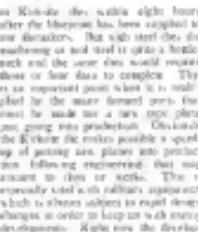
28. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



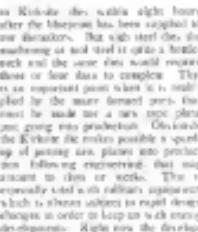
29. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



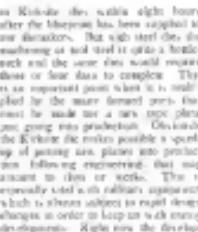
30. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



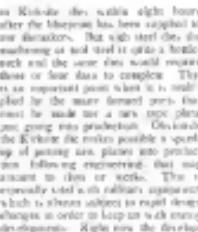
31. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



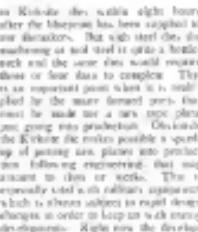
32. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



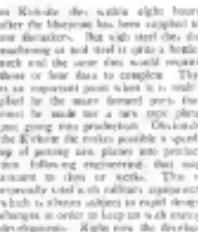
33. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



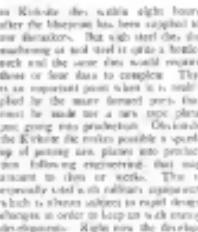
34. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



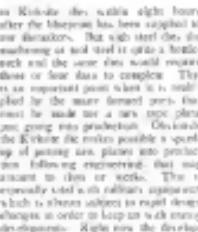
35. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



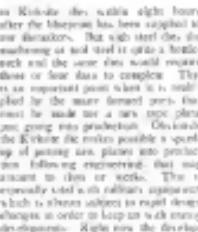
36. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



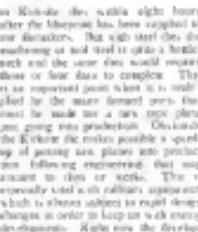
37. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



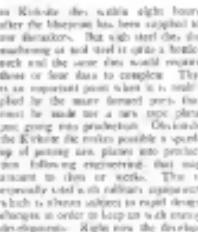
38. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



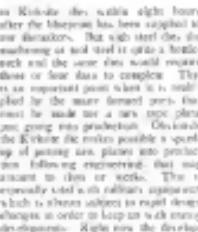
39. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



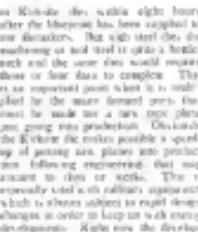
40. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



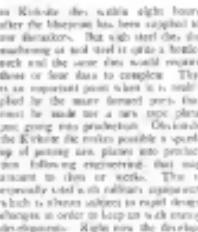
41. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



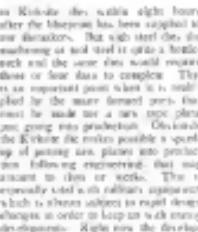
42. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



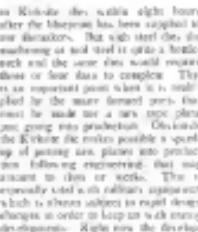
43. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



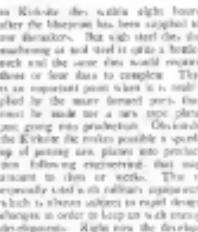
44. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



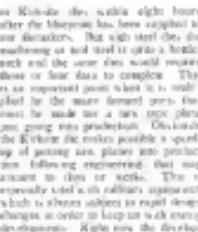
45. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



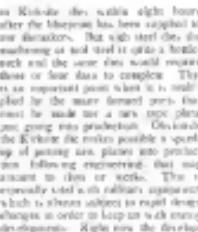
46. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



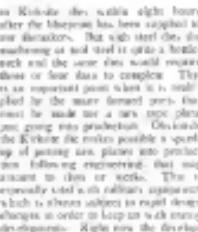
47. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



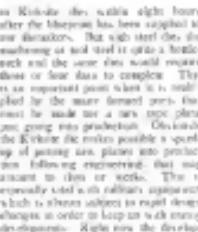
48. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



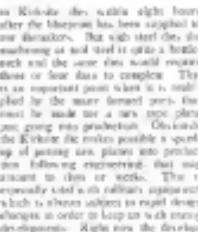
49. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



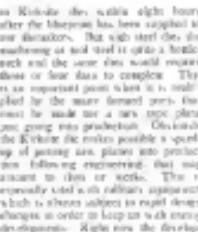
50. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



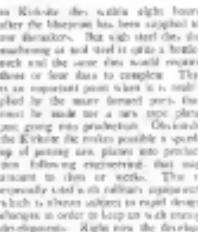
51. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



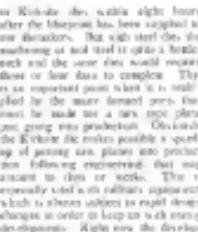
52. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



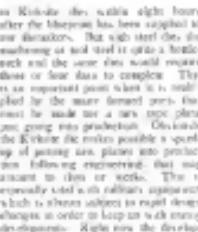
53. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



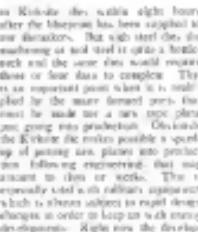
54. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



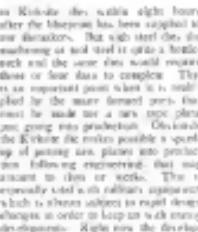
55. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



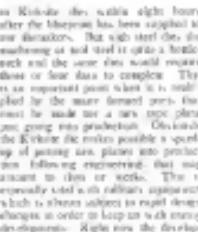
56. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



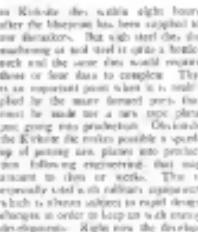
57. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



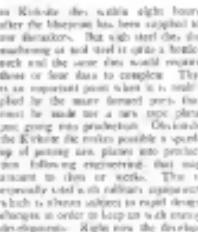
58. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



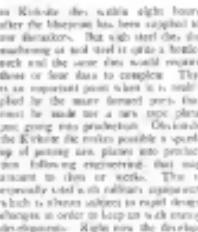
59. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



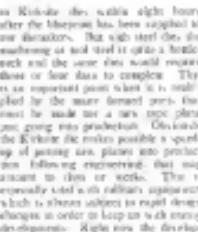
60. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



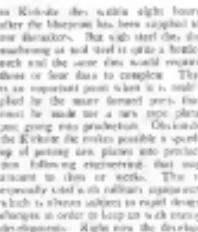
61. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



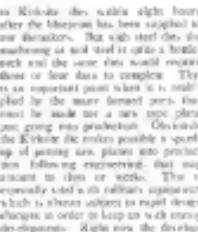
62. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



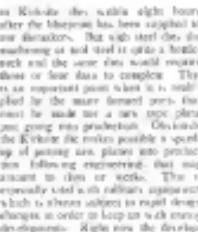
63. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



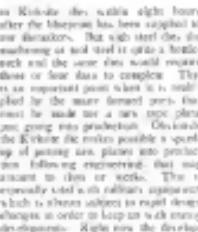
64. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



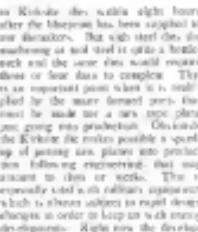
65. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



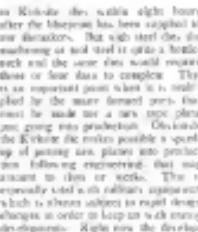
66. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



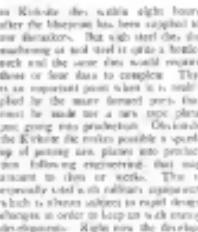
67. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



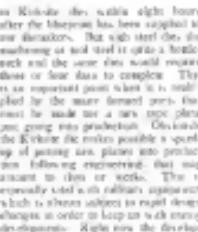
68. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



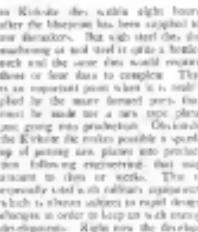
69. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



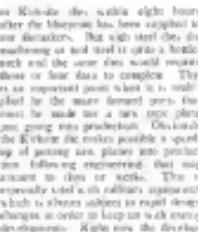
70. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



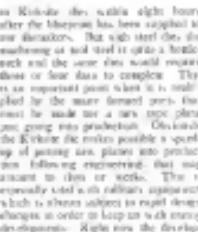
71. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



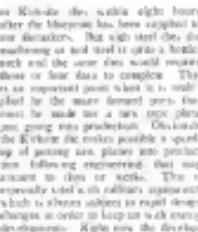
72. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



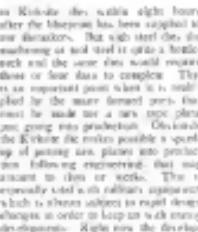
73. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



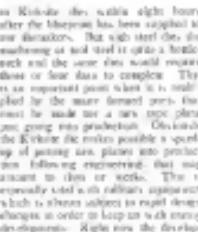
74. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



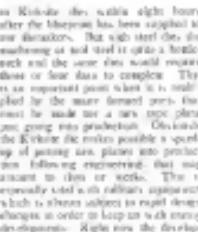
75. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



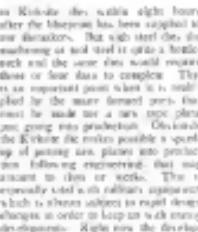
76. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



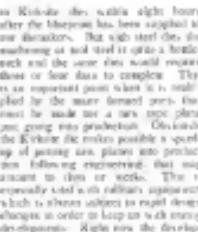
77. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



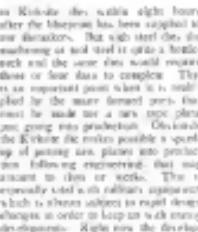
78. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



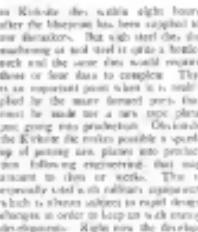
79. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



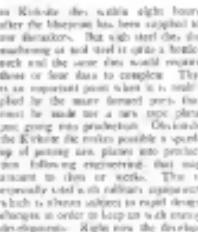
80. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



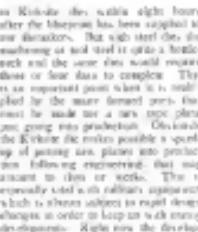
81. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



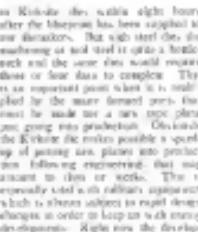
82. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



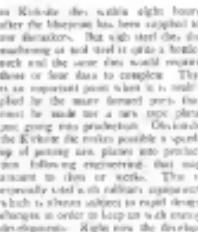
83. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



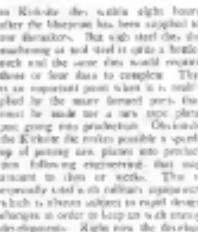
84. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



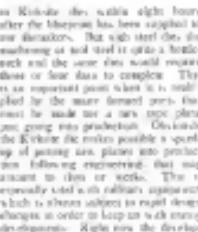
85. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



86. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



87. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.



88. Here 8 hrs and 7 minutes from its blueprint beginning, the machine holds a finished, instant replacement, clamped firmly during the die.

To Rule the Blue in '42



IN AMERICA'S all-out drive to win command of the skies, Goodyear Aircraft Corporation will play an increasingly important part.

Our big Akron factory is rapidly multiplying its output of wings, tails, ailerons, flaps, stabilizers, floors, nacelles, wheels, brakes and other metal alloy parts for leading airplane companies.

Great new planes built within the past year in both the East and West will soon be in production of additional subassemblies embodying Goodyear's long experience in aeronautical engineering.

In tires, tubes, bullet-sealing gasoline tanks and other rubber accessories our production is zooming to new peaks.



Final inspection of stabilizer, built by Goodyear Aircraft Corporation

Goodyear parts meet the most rigid government specifications. They are proving their high quality in many planes now in active service.

As the foremost supplier of parts and accessories within its field, Goodyear has pledged its every facility in making and buying this nation first in the air.

SPECIFY GOODYEAR AIRPLANE TIRES, TUBES,



WHEELS AND BRAKES

HOW GOODYEAR AIRCRAFT CORPORATION SERVES THE AIRPLANE INDUSTRY

1 - By building parts to most exacting specifications

2 - By designing new features of planes

3 - By manufacturing parts for plane production

4 - By providing fast research facilities to aid the solution of any design or construction problem



Fleetwings Steps Up Production

Some new tools by which this company has achieved greater manufacturing efficiency.

WHEN Fleetwings' factory engineers foresaw the demand for tremendously increased aircraft production for their plant, they granted themselves with more resources, and methods, than would normally be deemed. Headed by Mr. W. T. Givings, plant manager, they immediately initiated a high-quality, high-quality production system that would enable the company to deliver the aircraft parts and aircraft needed for the defense effort. For not only was the company going to supply enlarged quantities of fabricated aircraft parts, which it had built for years, to many major military airplane makers, but also wings, canards, and planes of a relatively unique design.

New, especially contrived machines were installed, including high-production assembly fast tools, and a bonded and one other plane model. One important move was to put a corps of special engineers on to work on the challenging job of getting out greater and better production. Secured—Yes, all of them. In that section you will see how the inventing and of course, the improving of new tools or build new ones that will do better and faster jobs, has earned remarkable results at Fleetwings. And that activity represents only one part of the silent progress for production. Here we shall describe only a few of the many productive ideas that have been put to work.

Rivet Binding Tools

This tool (see Fig. 1), which looks like a microscope, is used for setting

(See Fig. 2). There is no possibility of the rivet being offset. And the not pins for shelf ends and over again in the manner of time that it saves. The new locking pinset is now considered almost indispensable by Fleetwings' inventing engineers and a considerable number of various uses have been made.

Rivet Trimmer Set

The conventional method of drilling a rivet hole or an extraction hole, known as "drilling in an oxidation hole," by means of a right-angle drill, a pilot hole in the extraction and then complete the drilling from the outside of the extraction. That takes time—too much time. And the larger the hole, the more difficult it is to drill. So a resourceful Fleetwings' specialist de-

vised another place to assault rivets. Ordinarily, when riveting in locations that are difficult to get at, such as are encountered in stretching ribs to a beam through a lightning slot, the rivet is driven through the lightning slot and the rivet head is formed on the bottom. At least this method does not insure consistently good quality, for occasionally a rivet is offset due to the fact that the rivet locking does not hold up extremely well with the riveted. In such cases, inferior rivets must be drilled out and the operation repeated. Now, with the locking pin, one man does the entire job—and what's more, a better one. The free end of the bar is put in position for working with the locking pin, and the rivet is driven up with the tool. The rivet passes through an eyelet in the gun which is fitted through the lower part of the locking pin, the locking end engaging the lower end of the gun, and pulls the riveter trigger—completing the entire operation alone.



Rivet trimmer
set in action

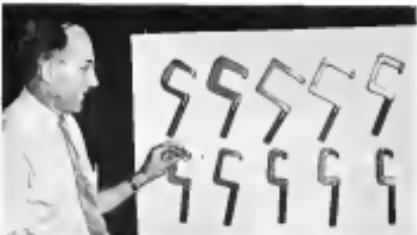
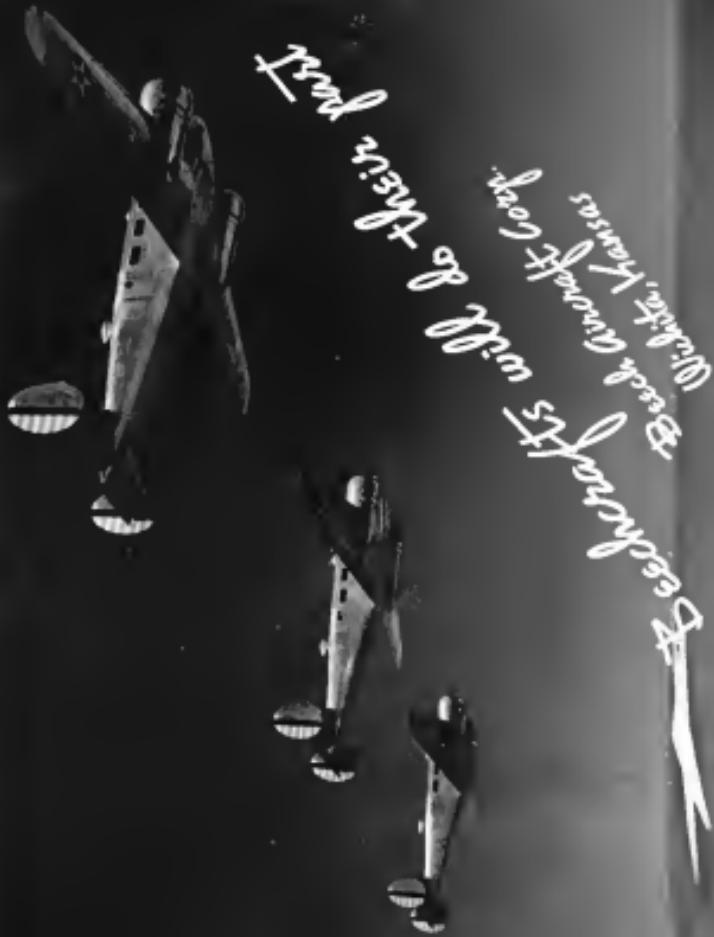


Fig. 1. Unique type of rivet binding pinset by which Fleetwings' engineers can do one plain riveting operation alone.



The Finest that Money Can Buy

**Two Types - 35 Combinations
of Openings Provide a Bonney Box Wrench
for Every Purpose**



TWO types—long and short—and 35 different combinations of openings from $\frac{3}{16}$ " to $\frac{53}{64}$ " make Bonney Basaloy Box Wrenches the logical choice of service and production men who need wrenches of this type.

Deep forged of Bonney Steel, carefully heat treated for maximum strength, they are long and thin, providing maximum leverage.

Handles are oval-shaped, affording a firm, comfortable grip and all sharp, flat edges are eliminated.

Box walls are thin, but of exceptional strength permitting adjustments in close quarters. Heads on both ends are offset and provided with clean, accurately machined, double hexagon openings. Like all Bonney Tools they have that balance which distinguishes all box tools.

Bonney Box Wrenches will meet every need for wrenches of this type. Write today for complete catalog giving full list of sizes and descriptions of all Bonney Tools.

BONNEY FORGE & TOOL WORKS, Allentown, Pa.
In Canada—Grey-Bonney Tool Co., Ltd., Toronto

Export Office—35 Paul St., New York, N. Y.

Stocked by Leading Jobbers Everywhere



use a transfer jig (Fig. 3) which leaves up the position of the hole to be drilled to the exacting diameter with the hole in the forging. Now the drilling operator needs only to drill over to complete the hole which is cast directly in the forgings; the operator then covers it entirely on to the next. This is in fact much drilling because the producer speed on the part by more than four times.

Drilling Bell

Prior to the final fabrication of aircraft skins it is necessary to bore the edge of the overlapping panel at the point where it will meet a corner, using a "drilling bell," or "cupping" as it is called, very frequently by increasing or by using a heavy bush roll. When one of the production experts saw this he set to work designing what he calls a "swinging roll" (Fig. 4). This cupping which is held steady in one hand, consists of a small steel plate, on which are mounted two half-hemispherical rollers. The edge of the plate of metal to be cupped is placed between the two rollers. This swinging motion makes the bend in made for the entire length of the panel of metal (Fig. 5). The result is a more uniform bend than is obtained at a greater speed.

Ring Punch

No more time—less—than the ever delta on the "Swinging Roll" can be used to assemble four. At least, the nose has greatly diminished. For now instead of drilling rivet holes with the conventional drills, the same result is accomplished in less than one-half the time by using a rivet punch (Fig. 6). Previously, when drills were used, the right-angle drills broke frequently; for-

thermore, the metal chips had to be cleaned from each drill hole before riveting. Now all of this is eliminated with the rivet punch. This new tool, which is especially designed for extremely fine work, looks much like a sputter, as shown in the photograph.

Welding Bell

In spotwelding aluminum aircraft splices as a welding machine it is

necessary that the work be maintained in a steady position so that the welding operator can get uniform results. Previously, to accomplish this, a man was used to hold the splice at one end in a steady position while the operator welded. But this was not necessary, for the man intrinsically tried, and to let go of the splice again, with a resulting drop in weld uniformity. (This is Fig. 12.)



Fig. 4. The "Swinging Roll" is used to cup the edge of an aircraft skin. The operator is holding the roll steady with one hand while the workpiece is held with the other.



Fig. 5. A completed aircraft skin showing the uniform bend achieved using the "Swinging Roll."



Fig. 6. The action of the rivet punch to form the position of the hole to be drilled in the panel directly with the hole in the forgings.



Fig. 7. A rivet punch is used to spotweld aircraft splices. It reduces time required and costs for production elsewhere as the worker can now do the job alone.





Fig. 1. Crankshaft assembled vertically on roller-shuttle press to centering chucks from rearstage to the background. Note the linear gear and shaft parallel to the crankshaft.



Fig. 2. After the sleeve bush has been mounted, rear stage of cylinder assembly.

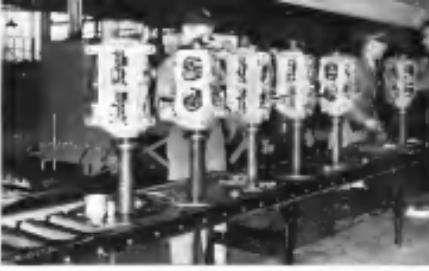


Fig. 3. The flywheel is bolted after the connecting rods have been assembled.



Fig. 4. A view of engine rolling along the line. Components have now displaced their fixtures and jigs, which are moved to the next station.

Roller-Line Assembly

Quantity production can be accomplished in many ways. This is a method used by Aircooled Motore Corporation which successfully fulfills its particular need.

QUANTITY production is not limited to production lines as commonly visualized as a series of conveyor belts and cranes—but that may never be the case. In fact, the industry is moving toward a family line as presented in but a few places, and even fewer in volume—not making automobiles. Producing a great many units of a similar kind can be done in many ways, utilizing many forms of equipment, but such ways as have a common base—that is, to bring the materials to the user, rather than the user to the materials.

Once a producer finds it thought of in this way it is necessary to determine the production desired that will be es-

pected from it. From here it is usually developed the simplest system that will fit the demand, but will, with some例外, be worked out by bringing materials closer than they are able to handle them. It is that this often presents the largest problem, and if a well-solved mass production may go into one part while a halfdozen others go on.

The Aercooled Motore Corporation solved its particular problem by using engines that were made of rollers, rather than being driven by power. This system filled the requirements of the organization since the engine was to be assembled from what it is supplied. With this in mind, it is apparent that at one time it did not do it as rapidly

that parts were being stacked waiting for cars on a particular cushion. It allowed the engine to be assembled without the weight of a hub could be turned to cause an even flow through the plant.

The complete production line is controlled by a series of three roller conveyor, but probably the most interesting location is the assembly line which is a unit by itself entirely segregated from the rest of the plant. In fact it is in a separate building adjoining the main production section and is conveniently located near the entrance of the department from which it is supplied. With this in mind, it is apparent that at one time it did not do it as rapidly

Fig. 5. Setting the valves in place. The rocker arms are pivoting on the cam shaft in houses of resonance.



Fig. 6. Tightening some of the stud nuts on the almost completed engine. The oil pan is bolted to the bottom.

in the manner that have been expected to meet the required tolerances. In this step the individual parts need not be inspected while being assembled, which would save delay, and the inspectors can concentrate on the groups of assembled parts. As a result, better motors are produced by this more evenly spread operation.

The assembly department consists of an engine assembly line and a drive line. The engine assembly line is the most important, and the drive line is to be used to move parts that the line would be unable to move alone if it were not for the line feeder line which takes care of building some of the sub-assemblies. The major work done on this feeder line is the assembly of bearing shells, which are to be inserted into the engine before the engine is to be used. With these in place, and other parts such as the engine support brackets attached, the cylinders are next in line to be assembled. Back in between the first feeder line and the second, which prepares the cylinders, put the bearing shells in place so that when the next feeder line is reached the inserted parts of the engine are ready for the cylinders. The cylinder feeder line is prepared to select the cylinders and the engine that are to go with them. This requires careful weighing of the piston so that the engine will operate efficiently at any speed, and vibrations will not result from a difference in

speed along the cylinder to the next.

Once the crankcase is ready for a power study the engine is ready for a power study. To this there are no moving parts that the line would be unable to move alone if it were not for the line feeder line which takes care of building some of the sub-assemblies. The major work done on this feeder line is the assembly of bearing shells, which are to be inserted into the engine before the engine is to be used. With these in place, and other parts such as the engine support brackets attached, the cylinders are next in line to be assembled. Back in between the first feeder line and the second, which prepares the cylinders, put the bearing shells in place so that when the next feeder line is reached the inserted parts of the engine are ready for the cylinders. The cylinder feeder line is prepared to select the cylinders and the engine that are to go with them. This requires careful weighing of the piston so that the engine will operate efficiently at any speed, and vibrations will not result from a difference in

(Turn to page 22)

Fig. 7. Assembling the exhaust ports. The necessary drive arm is in the rear of the engine.



Fig. 8. Testing the engine for leaks. The line to the engine absorbs oil at about 20 lbs per sq in pressure.





IT SURROUNDS FIRE!

... The Ring of Protection Quickly Smothers Engine Blazes



BEST WAY Fire Department response depends upon rapid fire extinguishing equipment. Equipped with LUX fire extinguishers, fire departments are better prepared for emergency requirements.



OVERS EXTINGUISHES When water and foam fire extinguishers operate, they must be recharged almost immediately. But LUX extinguishers are built to withstand repeated use.

The instant your wheels leave the ground, as an engine fire becomes a difficult problem. You've arrived, then, on your own and you can't get to a nearby ground crew.

Nevertheless, you can always know the answer. 9 out of 15 of them carry a slender metal ring which blights a blizzard of carbon dioxide spray into every inch of the engine compartment. Fire lives about 3 seconds.

This is LUX protection from the lightweight LUX Airplane Fire Extinguishing System. A small cylinder of carbon dioxide delivers its fire-killing charge the instant the

pilot pulls its release control. LUX fire extinguishers give quick warning by sounding bell or flashing light. Threaded valves prevent any LUX cylinder to become inverted and to damage internal membranes on multi-engine planes.

LUX gives fast-moving, sure protection against engine fires. More aircrafts, more private planes, more U. S. Army and Navy planes are protected by LUX than by any other type of bulk-in-fire extinguisher.

For instance, "White Magic," describes LUX fire extinguishing systems, like LUX portables for airplane cabin, or hangar protection.

Write today for your copy.

Walter Kidde & Company, Inc.

122 West Street

Bloomfield, N. J.



AVIATION, January, 1948

A crystal-clear synthetic solid age-proofs this tracing paper

MOTOREX OIL Most reliable solvent for removal of adhesive gum from aircraft surfaces. Motorex is a non-flammable, non-toxic, non-corrosive solvent which cuts through the most tenacious adhesives.

WINGSTAB OIL An especially well balanced solvent for removing paint and varnish from aircraft surfaces. It is a non-toxic, non-flammable, non-corrosive solvent which cuts through the most tenacious adhesives.

ALBANESE is a permanent writing surface with the best ink and water resistance. It is a synthetic solid which resists all solvents and organic solvents. It is also unaffected by heat, cold, and moisture. It is a non-toxic, non-flammable, non-corrosive, and non-staining material.

No oil, no wax—just a masterpiece of waterproofing! A great development in the K-E laboratory—so strong, so tough under constant stretching, flexing and rough handling ALBANESE has all the working qualities you've always wanted—and it will retain all those characteristics indefinitely.

TRY ALBANESE yourself on your own drawing board. Ask your K-E dealer, or write us, for an illustrated brochure, or write us, for an illustrated brochure, and a generous working sample.

KEUFFEL & ESSER CO.
NEW YORK • CHICAGO • BOSTON
PHILADELPHIA • LOS ANGELES • SEATTLE • BIRMINGHAM

K&E **Albanene**
THE STABILIZED TRACING PAPER

Wood-Plastic Airplane Parts

Plastic-bonded plywood is increasingly coming into use in the production of aircraft. In this article is described a phenolic resin bonding method called Wood-plastic.

By CURTIS L. BATES, Chief Engineer, Pinnewa Mfg. Co.

THE aircraft industry is making a bold effort to replace strategic materials, especially aluminum, with substitute materials. Obviously, such substitutes must be capable of providing parts of equal or better strength and lighter in weight and easier to fabricate in appearance. The implication is, of course, that the use of other materials, especially those already available, will alleviate a threatened shortage of light metals and, perhaps, will help prevent an unnecessary depreciation of metal production facilities.

One of the best substitutable materials which is inexpensive or being used in an extensive manner is wood. The Pinnewa Manufacturing Company chooses to call it Wood-plastic. It is believed that this term is more descriptive than the wood plastic name. With the exception of a few minor parts all of the so-called plastic airplane developments are, in reality, wood parts which are phenolic-strengthened or bonded with plastic adhesives. Thus, internally spruce and plywood are coming to the rescue of the aircraft industry. The Pinnewa Company has been engaged in the development of wood construction for a few years ago. Recently, too, aircraft is classified as a plastic but no one ever thought of attaching the rough wood "plastic" to the all-metals-housed aircraft phenolic. It remained for the advent of phenolic bonding of plywood to bring that about.

Actually, great advances in the materials were in the bonding of wood-plastic parts to metal plates in the past few years. Much of the early work was in now bonded with phenolic adhesives. This new phenolic development is a distinctive note because its characteristics are so close to those of the plywood as to use as far as 1931. The phenolic film in the new plywood is a true plastic and acquire most of the favorable characteristics of phenolic to the plywood aircraft. This new material can be soaked in boiling water, and can be extremely soaked and dried for many months. The bonding material does not prevent fu-

ture treatment has been done by a few plastic companies and by the Forest Products Laboratory. The insulation in wood research has been only a small fraction of that spent on light alloys, and not much of importance has been published. It is unfortunate part of the better understanding of the new materials and methods does not exist in many places. Measurements based on design data or relative to earlier years are not available. The author has been told that one said "It is the same wood as we have been using," except in a statement of the fact that other materials change the characteristics of the composite structure. The effect of the plastic bond and trish on plywood is almost equivalent to alloying elements in metals.

Regarding the durability of wood-plastic structures, an allusion of Deich K. L. in his remarks, "The fact that wood structures can be made satisfactorily under normal conditions for aircraft uses has been definitely proved. That light alloy structures may be similarly constructed upon remains to be proven." And these remarks were based on the old spruce and metal construction.

Modern technical woodworking requires a high degree of engineering skill to take full advantage of modern materials. A thorough knowledge of the different types of woods and various species of American timber is the first requisite. Familiarity with the plastic adhesives is essential. Above all, the knowledge of modern plywood construction problems and the ability to solve these problems in wood and plastic designs must be combined with the ability to efficiently build the parts in a productive manner.

The Pinnewa Manufacturing Company has had some interesting experi-



Curtis L. Bates

ence or historical growth as certain other observers did in fact experiment that certain conditions which normally produce mold will cause deterioration in the wood but the phenolic remains intact.

Modern plastic fabrics make the new material fire-resistant and almost completely impervious to moisture. To effect the plastic bond and the plastic design must be combined with the ability to efficiently build the parts in a productive manner.

Most of the research on Wood-plastic



A applied group of parts that can be built in subassemblies of Wood-plastic materials in place of metal. These include nose cone, tail shims, and interior partition parts for aircraft applications.

ment in developing wood-plastic parts. In general, thousands of parts already developed in metal have been submitted to Pinnewa for redesign in wood-plastic construction. This has led to many engineering problems, new methods of attachment and even new conceptions of design methods.

One of the most difficult problems in Wood-plastic construction has been the method of attachment to other parts of the structure and the proper design of fittings which are required to carry loads. This has been solved by research and development work, resulting in a method of fastening metal reinforcing plates and plastic inserts to plywood to develop heavy strength, and by the development of a similar fastener which is being applied in many designs.

Research has also been carried out in the development of plastic fasteners. These are now commercially available and are being extensively used.

The wood-plastic developments of the Pinnewa Company begin as an attempt to develop a new aircraft material. In this regard, the material has shown so many interesting possibilities that the designers now working with it realize there are many applications in which it will continue to be used after the "wood-plastic materials" problem comes to exist.

Some of the important factors in this construction are discussed below:

Stressed parts, especially small components, are not yet considered for passenger cars but can be fibered with smooth uncoated unglued carlites. With an over head in every sheet and with a dry material which is stiffer for a given weight, it is often easier to maintain the desirable skin smoothness with wood-plastic construction than with metal.

New fabrication methods have made assembly of parts in aircraft using plywood or phenolic materials very simple for corresponding parts. In many places, these are concentrated in working on metal coated surfaces. The thin trailing edges frequently made from sheet metal are nearly impossible. Since the skin of the wood-plastic parts is applied without adhesive such as epoxy, this problem is not present with this construction.

In aircraft applications the wood-plastic parts can be produced in reasonable cost. Obviously this cannot be true for all parts of the airplane. Obviously also present prices must be based on present methods of fabrication. As new and cheaper methods of joining are developed these costs will be lowered.

The materials involved in wood-plastic construction are readily avail-

able. It is estimated by the U. S. Government that 20% lumber production of all wood products in our forests is enough to power a beginning aircraft and many fine long side trunks lie along the roads. Miles, that will build a lot of tails and rudders and floor boards, side panels, and wing根's tables.

3. The work of fabricating these wood-plastic parts can do, to a large extent, be well already trained in



Reinforced side, shown with and without covering sheet to illustrate method of construction.



A trussed sheet section of Wood-plastic design. This development aircraft 120 lb of four material in a trusseng design.



A wood tail legept end on Wood-plastic construction. Note the superior encapsulation qualities of the Wood-plastic tail.

woodworking and presently available. Cabinet makers under fair supervision are proving to be a valuable source of manpower. Have again paper coating is making it possible to use comparatively inexpensive labor in a large extent. Thus this new construction is reducing not only the material shortage but the shortage of skilled aircraft workers as well.

6. In many cases the wood-plastic construction turns out to be lighter than the equivalent structure in metal. Again this is by no means universally true, but it is true that in tail and similar applications where weight is of vital importance it has not been difficult to meet or better the weight in metal.

7. Parts of moderate complexity can often now be molded from plywood sheets. Where the curvature is more severe however, it is difficult at the time of writing. It is then necessary to produce parts of practically any shape.

The development of material wood-plastic parts has not been as simple as might be expected. When airplane strengths going 400 to 480 miles per hour the design loads are far different from those on structures being designed ten years ago. These higher loads have been problems to handle in metal, not of course, are no less so in wood-plastic design. Further when required to meet all the structural requirements, the mechanical strength of the metal parts becomes to multiply at an alarming rate.

The problem of fitting of wood parts in one to which more strength can be given. In some cases the cost of finding strength equals the cost of fabricating the parts. Not infrequently the fabricating cost actually exceeds the material cost. In other cases there are many advantages which make wood better than wood but the cost is considerably higher than a similar part stamped from sheet metal and requiring finish. In this respect, aircraft companies are calling for metallic aluminum rules on small plastic parts. This is the most difficult and most costly finish to apply. It is suggested that if the airplane is to be painted or varnished, the parts should be finished to some finish other than paint alone.

In production it is desirable that all work be done in air-conditioned rooms. The resins used do not set properly below 70 deg. F. and the shape and size of parts in process of manufacture tend to change with changes in relative humidity. Once the part is completed and the finish applied, the dimensions are stabilized. See diverse manufacturers (Turn to page 142)

X-Ray Inspection and Supplementary Technique

Industrial applications of x-ray technique saves money for manufacturers.

By H. M. Mancheryan, Physicist, Aircraft X-Ray Laboratories, Huntington Park, California

In attempting to give an account of the present application of x-rays to industrial inspection of metals there are two essential points to consider. First, x-ray inspection is a supplementary method to the standard of evidence obtained by the visual examination of the internal constitution of suspect articles by non-destructive methods. Second, by authentic evidence secured through x-ray procedures, the efficiency of the manufacturer, designing engineer, or the quality personnel is increased to the potential value of such inspection, aiding them in improving markedly the quality of both their products and techniques.

With the aircraft industry having been fully accepted, the manufacturer becomes eager to co-operate with x-ray testing laboratories in an effort to produce sound and dependable material, thereby increasing production that is mechanically reliable, saving time, money and much expense, and finally securing public safety.



Fig. 1 Radiograph of suspension roller showing a white streak of RIMy composition in upper left spike. 20x ray shows closed lower left spike held stationary characterized by discontinuous drift lines.

Modern demand for high speed production requires in the economy and maintenance of our progressive nation has given rise to the development of high capacity x-ray equipment supplemented by high-speed x-ray film having sensitivities as high as 30 frames those employed during the early stages of industrial radiography. This will be appropriate basis for consideration the possible danger resulting at high speed production in fire tendency for the insulation film up to 180° F.



Fig. 2 Radiograph I shows wire mesh with incrust puncture. Note complete loss of definition. Radiograph II was taken after spikes having been treated by a new process. Note sharpness of detail.



Fig. 3 Photomicrograph view of the precipitated unites of the aluminum rich suspension solder solution of the white streak shown in Fig. 2. Magnified 250x.

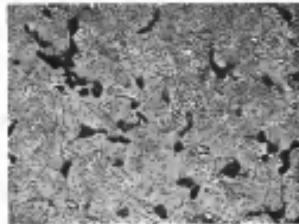
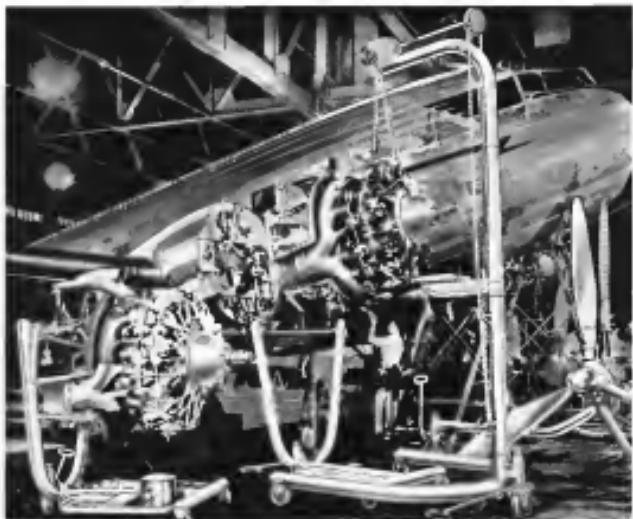


Fig. 4 Photomicrograph view of the precipitated unites of the aluminum rich suspension solder solution of the white streak shown in Fig. 2. Magnified 250x.



Here Are "Service-Tested" Answers to Maintenance, Production, Handling Problems

The versatile experience and complete manufacturing facilities of Whiting Corporation are coordinated by the Aviation Department to make available an unusual service to the aircraft industry.

Whiting products include an extensive line of service-tested, machined maintenance and handling equipment; special cranes, hoists, and aerial working machines. In addition, Whiting engineers develop new devices to customer specifications, and the research staff is engaged to work with you in solving your problems upon request.

WHITING CORPORATION • Aviation Department

Mass Office and Plant 13021 Lathrop Ave., Harvey, Illinois (Chicago suburb)
Western Office 1001 Hollywood Blvd., Los Angeles, Calif. (Phone Glendale 94-0000)
Branch offices in New York, Philadelphia, Pittsburgh, Detroit, Cincinnati, and St. Louis

WHITING

Aviation Department

Curtiss Propellers

Pioneer Advanced Design



CONTINUING improvement in aircraft design, with higher engine power for greatly increased speeds, has imposed upon the propeller of today tasks which were unknown yesterday.

The Curtis Electric Propeller has not only kept abreast of these engineering requirements—for 12 years it has pioneered the way to new performance concepts. Today, a highly versatile mechanism, it has taken upon itself many of the duties formerly required of the pilot—a fact of increasing importance to those who have taken to the skies in Defense of America.



Four Bladed Propeller—Permits absorption of higher power in smaller diameter, providing the performance which is essential to stratosphere operation.



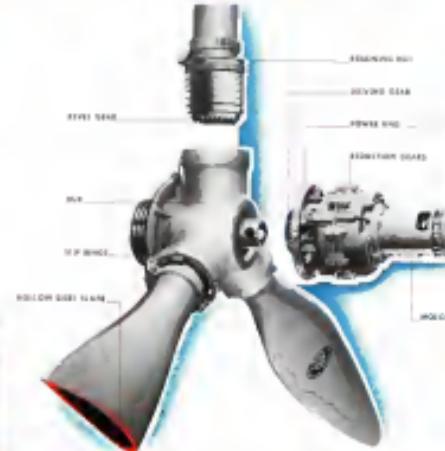
Feathering — By turning the blades of an unpowered engine sideways to the slipstream, performance of a multi-engine plane is greatly increased.



Hollow Steel Shells—Save much valuable weight in the larger diameters their strength offering maximum resistance to damage and abrasion.



Bistic Shank Cuffs—Biscuit cooling on ground and on flight because of smaller coal opening. Thus requiring standardizing of coal engines.



Unit Construction Simplifies Maintenance

Curtiss Electric Propellers are designed with a view to interchangeability and ease of replacement of such basic units as blades, the unique single-piece hub, and power unit comprising motor and reduction gearing. This characteristic simplifies maintenance problems, adds greatly to the speed of replacing vital parts.



All-Temperature Operation— Carbon Electric Propellers are capable of uniform service under extreme conditions of altitude and temperature.



Selective Feed Pitch — Siemens advantages of fixed-pitch fan checking engine operation, allows feed pitch control for minimum fuel consumption.



Causeau Path—Permits aircraft cameras to be fired through hollow propeller shaft — Inset of design of the famous Bell Autoguided Flying Camera.

AMERICAN BRASS COMPANY • *The Brass Company* • 4 EAST 42nd STREET, NEW YORK, N.Y.

• 100 •

CURTISS *Electric*
EQUIPMENT



CUSTOM DESIGNED FOR FIGHTING AIRCRAFT

The modern airplane has demonstrated its ability to take an amazing amount of punishment in combat, but the fighting man who flies it still needs armor. Aircraft armor is specialized, for it must be highly resistant yet light in weight.

The most severe tests conducted with actual use have proved conclusively that Breeze Armor Plate for aircraft is unequalled in ballistic qualities and resistance to shrapnel.

Engineered to designers' special requirements, Armor Plate now supplements the well known use of Breeze as a connector for aircraft, insulation and marine equipment.

Breeze
CORPORATIONS INC.
NEWARK, NEW JERSEY



BREEZE
MASS

Because Armor Plate
possesses the highest tensile
strength per gauge thickness

It offers the highest wear
resistance to protect its strength
in service throughout.

Custom tailored, it can be
produced in a range of sizes
to meet any aircraft need.

The Breeze Electric Resistor
process is the fastest way
to get armor plate produced.



WHICH ROAD WILL YOU TAKE?

Yes, there are jobs in the aviation industry today, but as far as the future is concerned, success depends upon proper training in order to make it a career. It is the career that Boeing School of Aeronautics offers. For in this school you have the choice of 8 different career courses embracing 35 subjects. These are indicated below. If you are ambitious about your future in aviation, fill in the coupon and mail it today.



The next classes, both for general school and flying courses, start January 10, 1942, and January 20, 1942. Fill out and mail the coupon now for application forms. You will receive complete information regarding Boeing School of Aeronautics, its many namesakes, Boeing aircraft, and also the new 12 month Defense Pilot Course. Fill in the coupon now and mail it today.

Boeing School of Aeronautics
1000 Rainier Ave. S.
Seattle, Washington
Statement: Please forward additional information as to the Boeing School Bulletin section
Name: _____
Street Address: _____
City: _____
State: _____

Pilot Training

- Commercial Pilots
- Flight Engineers
- Airline Pilots
- Radio Telegraphy
- Radio Telephony
- Aviation Mechanics
- Aviation Mechanics
- Personnel
- Ground School
- Safety Flying
- Instrument Flying
- Navigation
- Precision Flying



BOEING SCHOOL OF AERONAUTICS

UNITED
AIR LINES
A DIVISION OF



Secure photograph of the latest version of the Sikorsky Autogyro, known as the Sikorsky. Flying the craft is Lee Shultz, member of the engineering staff and helicopter test pilot. Those who viewed the earlier version will notice immediately how much the design of the helicopter has been cleaned up and simplified.

Helicopters Of Tomorrow

Igor Sikorsky reveals plans for new rotary-wing craft, predicts wide use after war.

ALTHOUGH it is impossible to profit from such a public demonstration, I still believe the time of small, safe and economical helicopters is coming," said Mr. Sikorsky. "I am confident that the manufacture of helicopters in quantity will be an important factor in absorbing a large part of the productive capacity of the western industry, just like by doing so much work in military orders after the war."

Skilled with the success of his present helicopter, which has been flying over a period of two years, Mr. Sikorsky told a number of Aviation's staff of his plan to develop a larger two-place helicopter with an engine of about 200 hp and with a gross weight slightly over a ton.

"The question is, will man ever replace the airplane? Is it, in fact, long distance travel, and for carrying heavy loads?" he declared. "But it will be a very useful craft for all kinds of commuting, as well as between a person's home and the airport, and will be used to provide aerial transportation within the reasonably short range of the average person's travels. Larger units, carrying up to six or seven persons, will probably find their use in air service to metropolitan airports."

Such a helicopter, he said, in manner, the same aerodynamic design as is his newly fashioned aircraft. In one corner of the hangar of United Aircraft's



Igor Sikorsky

Vught-Sikorsky Division at Stratford, Connecticut. The machine on which the Heliosphere Series, which last month launched the first of three VS-300 giant four-bladed luxury liners which will fly the aerial trade routes of the North Atlantic for American Export Airlines, is an long ago.

On the basis of his experiments thus far, Sikorsky does not believe that a true helicopter can be developed so that it could exceed a speed of 150 miles per hour, but because it can take off from a very short stand and hover above a given spot with very little swaying it is a most useful means of transport.

Furthermore, the helicopter will be a very safe form of aircraft particularly for the non-professional flier. In design eliminates the dreadful stall and spin of conventional fixed-wing airplanes and in event of engine failure becomes automatically an auto gyro, with considerable latitude of control for speed and direction of descent, thus affording the opportunity to select a suitable landing area in a wide area.

He pointed out that the helicopter also has great military possibilities for airborne spotting and many other operations and liaison activities, but most of all, for rendering quick medical or other assistance, and for saving lives under the greatest variety of circumstances and over sea. He stressed, however, the fact that an enormous problem lies in the development of a powerful enough power plant.

Mr. Sikorsky was born in Kiev, Russia, in 1889. He began his aviation experiments in 1908, and by 1913 had built what was then by far the largest airplane in the world. Called the "Grand", it had a wingspan of nearly 120 feet and was powered by four 100-hp engines. The giant ship had a glass-enclosed cabin and a "captain's bridge" in the nose. Ever since he has campaigned the large multi-engine airplane and has led in their design, particularly the ongoing flying boats and the large amphibians.

AIRPORT, January 1940



These are VARD's contributions to American manufacturing supremacy

Here are twelve products, developed in our engineering department and converted into commercial manufactured items in our technical shape.

These twelve fall into three classifications: precision checking tools of high fidelity; operating instruments for aeronautic and space measurement; and special goods and a process of making optical glass.

In the picture above, No. 1, shows a Vans precision tap. We hold close to size of special sets, special end and hand threads—on face, the lead hand to get a neater size. No. 2, is a universal thread size gage. We hold down in a wide variety of sizes with similar cylindrical ring gages. No. 3, is a plug gage, with "Go" and "No Go" threads. Thus, as well as cylinder plug gages, we hold all sizes. No. 4, is one of our plain taper ring gages for checking pipe threads.

For more sensitive and accurate than the first four, are the Vans internal comparators, Nos. 5 and 6, above. These beautifully made dividing instruments, quickly reduce variations in size of

work one thousandths of an inch. Both are bench models, easy to move and easy to read.

No. 7 is a circular dividing machine. It accurately divides circular diameters into predetermined segments. It is used in the manufacture of disks, pointers and instruments. We build both circular and linear dividing machines.

Autom operating parts of planes, such as the hydraulic cylinders, No. 8, and wing flap surfaces, No. 9, are precision built in plane manufacturer's wings. We have round out a good quantity of such equipment and are now increasing our plant to handle more.

Optical lenses, mirrors, and filters, as shown in Nos. 10 and 11, are important among our products. In the processing of some of these items, we use a newly developed scientific method of vacuum evaporation, No. 12, to deposit durable coatings on the glass. These coatings, either form a brilliant reflecting surface, or mirror, or materially reduce surface reflection, as lenses or plates. This process of CVD is a new scientific discovery.

In 1942 Vans will continue to serve the U.S.A. and you

The VARD trademark on a pedestal symbolizes through engineering, the best in materials, and technical, precision workmanship. PALMDEA, CALIFORNIA, U.S.A.
VARD MECHANICAL LABORATORY

ANOTHER AERO TOOL DEVELOPMENT



A Stop Countersink with Instantly Adjustable—Absolutely Accurate Micrometer Setting...

Aero Tool's year's-ahead design and precise craftsmanship is typified in this new Micrometer-Stop CounterSink. Gets a smoother, more accurate hole to predetermined depths for flush rivets and screws—won't mar metal—adjusts quickly and easily by slight thumb pressure to tolerances of .001—won't shake, walk or run hot—can be locked tightly and instantly at each micrometer position.

Also fine ahead in features and design are the many other production tools developed exclusively for the Aviation industry by Aero Tool. For the rule here is to "make it better—or don't make it"—and there's no digression from this policy!

Originators of Cuffforged and Microglow Knobbed Riveting Equipment, Aero Tool steps out in front by Comprehensive Inspection of all products to ensure perfect surface finish and dimensional accuracy. Perfection of Aero Tool, here is a keynote, too.

ADDITIONAL AERO TOOL PRODUCTS INCLUDE—

- Dimple Dies
- Dimple Punches
- Busing Bars
- Back Spotfacing
- Cuffforged Riveting Equipment

Send the page from this advertisement for the illustrated list of Aero Tool's Production and Maintenance Tools including Riveting Sets, Drilling Tools, Stop Countersinks, Head Setters, Line Gages, Die Assemblies and Drill Sharpening all in Aero Tool Standards.

AERO TOOL CO.
CUFFFORGED AVIATION TOOLS

AEROTOL COMPANY, 101 WEST MARY AVENUE, BETHLEHEM, PA.

AVIATION, January, 1940

ULTRA HIGH FREQUENCY

by Bendix

Sons of the
BENDIX
ULTRA HIGH FREQUENCY
EQUIPMENT

which will be
available soon

BENDIX U.H.F.
Two-Way
Communication Units

BENDIX U.H.F.
Ground Station Transmitters

BENDIX U.H.F.
Range Receivers

BENDIX U.H.F.
Ground Station Receivers

BENDIX U.H.F.
Marker Receivers

EMERGING from the Bendix Laboratories is an entirely new line of Ultra High Frequency Radio Equipment. Following exhaustive tests, perfected models of Bendix Ultra High Frequency Radio Equipment, for use in the air and on the ground, are going into production. **BENDIX RADIO**, Division of Bendix Aviation Corporation, Baltimore, Maryland. U. S. A. Cable Address: BENRAD.

BENDIX
RADIO

STANDARD FOR THE AVIATION AIRLINE

Aircraft Hydraulic Pumps

The third article in a series on aircraft hydraulic mechanisms.

By LIEUT. HARRY J. MARX, U.S.N.R.*
and EDWARD M. GREER

Hydraulic Engineers, Standard Aerocessors Co.

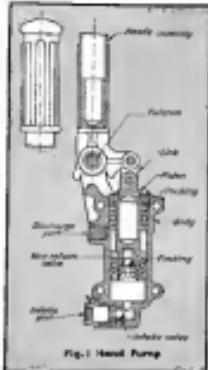
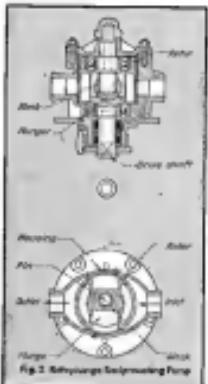


Fig. 1 Hand Pump



* On leave of absence from Aerocessors Co.

THIS growth of military aircraft, in size and increased stresses, with the necessity for increasingly high speeds have enlarged the demands on the aircraft hydraulic system. Increased rates of rotation give the problem of disc drag, hydraulics can turn this into a gain of power than the gear pump in general use before this was, naturally, could possibly produce. These demands involved in the development of hydraulic units using increased pressures so as to reduce the weight of hydraulic equipment, the quantity of oil carried and to ease the installation problems created by the use of large, standard pressure, rotating cylinders.

At present, the best effects at present are of around 3000 lb per square inch. Today, most aircraft manufacturers have located their hydraulic systems to operate at 3500 lb per square inch, decreasing the use of reduced pressure or compensating pumps for this work. However, in many cases new designs call for pressures of 3000 lb per square inch. Here the gear pump and the compensating pump pressure will be the same. In effect, our largest airplanes and their hydraulic systems pressures ranging from 3000 to 4000 lb per square inch. To study these requirements all major pump manufacturers are now deep in research work on this problem endeavoring to develop an efficient pump which will operate effectively at these pressures under the extremely trying conditions possible by modern flight.

The compensating piston type pump is the only design that can efficiently produce low leak delivery pressures, high output pressures and high efficiency. This type of pump is relatively new on the U. S. and is being produced only in limited quantities to date. Frequently references of the various types are necessary, and extensive research pro-

grams are in progress to bring these pumps up to American aircraft standards. Although new in this country, many types of compensating piston, gear-driven pumps have been in service for many years. For this reason it is possible to consider the European pumps, although one dimension is particularly concerned with American designs.

The main advantage of the compensating piston type pump is that the pistons can be easily fitted into their bodies without clearance causing friction 0.0005 to 0.002 in. or less depending on their use, thus reducing leakage to an absolute minimum. The basic disadvantages of this type of compensating piston pump are the axial clearance of the piston rod, the axial clearance between the piston and the cylinder, and the clearance in the housing of the pump.

Today due care is exercised in design, nonconcentric effects may be compensated with resulting pulsations in the system. Also, if the speeds become too high, cavitation or resonance will arise in the pump, with consequent damage in the system. The manufacturer must be consulted concerning the number of valves used and the pressures are required and. Cavitation can be eliminated by reducing the acceleration of the inlet oil by enlarging the intake opening.

The requirement of intake and discharge valves in this type of pump introduces another series of problems. In most of these pumps, each piston must contain an intake and outlet valve either at the top or bottom of the piston. These normally must be quite small, thus not only complicating the design but reducing the problem of eliminating cavitation quite a difficult task. Some designs have eliminated the necessity of placing a set of valves in each cylinder, by placing three cylinders in a star assembly rotating on a fixed shaft, which contains the intake and outlet valves. However, the single set of intake and outlet valves

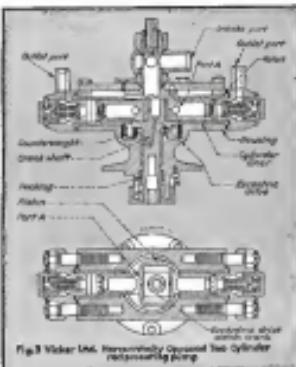


Fig. 3 Vicker Unit, Horizontally Opposed Two-Cylinder Reciprocating Pump

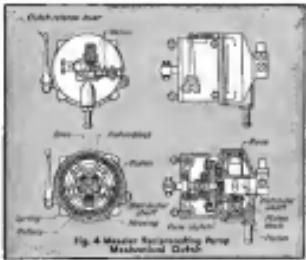


Fig. 4 Master Reciprocating Pump Mechanism

are still necessary as well as to pass the fluid for the complete set of cylinders. In either case it can be seen that the efficiency as well as the speed of operation of this pump is limited to how large these valves can be made.

Compensating piston pumps can be outlined in the following types:

1. Simple reciprocating piston pump
2. Constant speed operated—Buna Pump
3. T. H. & J. Davis—Great Britain. Horizontally opposed pump—Vickers Aeronautic Ltd.—Great Britain
4. Rotary Roded Pump
5. Compensating piston pump
6. Double-acting operated—Buna Pump
7. Dowsy—England & U. S. A.
8. Eclipse
9. rotary Axial
10. Vickers, Inc.—U. S. A.
11. Fossor—U. S. A.
12. Brook Pump
13. Clark—France
14. Standard Aerocessors, Inc.—U. S. A.

Brook Pump

The simplest type of compensating pump used in aircraft is the hand pump. Although a power driven pump is used in all airplane hydraulic systems today, a hand pump is also installed for the following reasons:

1. For emergency operation of the hydraulic system in case of engine or power pump failure.
2. For operation of flaps or other mechanisms on the ground when engine

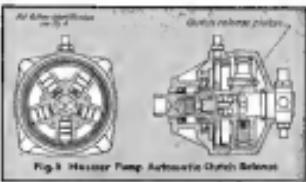


Fig. 5 Master Pump, Automatic Check Valves

is not running.

3. For pressure testing pipe lines and fittings as well as hydraulic units.

4. For operation of tank doors on loading the bomb racks without running the engine.

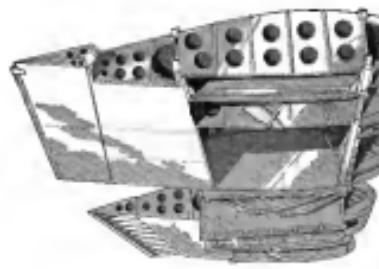
Although a great many manufacturers of aircraft hydraulic equipment are manufacturing hand pumps, these are all essentially the same from the standpoint of design and operation. Standardization on this unit calls for an output of 1000 lb per square inch at a maximum pressure of 1800 lb per square inch giving approximately 100 lb handle load. A typical section of a hand pump is shown in Fig. 1. In this Figure it can be seen that this pump is constructed as follows. A housing receives a single cylinder, the intake and outlet ports and the handle mounting. A piston is inserted into the cylinder and is held in position through a packed piston and mounted by means of a link to a handle lever whose fulcrum is attached to the handle provided for the handle grip. The piston is in hollow and contains a nonreturn check valve. Also a set of outlet holes is drilled in the piston just above the piston. A check valve is also incorporated in the intake port. When the piston is pulled into the top position, a charge of oil is drawn in, completely filling the space below the piston. On the down stroke the intake valve prevents the air from

European Pumps

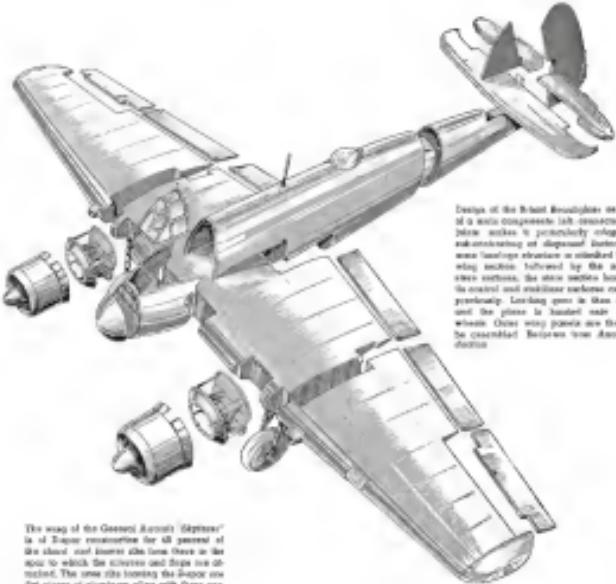
The first applications of compensating pumps in aircraft were made in Europe. In fact, many of our American designs are based on European designs. The simplest pump to be designed for aircraft application is the T. H. & J. Davis Company of Great Britain. Referring to Fig. 2, it can be seen that this pump has the following parts: (1) The axis, which is built for lightness, is part of the drive shaft. (2) The plunger which fits into the cylinder and has its ends shaped to

(Turn to page 215)

AVIATION
S
ETCH BOOK
OF DESIGN DETAIL



A At left is the center wing section which forms the front part of Front Boeing's assembly work. Two large panels on the underside one of which has been removed as shown at the forward end of the section, are made of sheet metal and riveted. They are covered by closely spaced step nuts. Flank riveting is used throughout on all aircraft sections. Reference from: Aircraft Production.

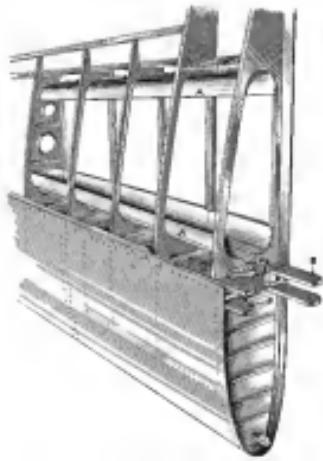


B Drawing of the Boeing B-17 fuselage as a section of a main compressor, job numbered 9-100000, is approximately 1000 inches in maximum width and 1000 inches in maximum height. The nose landing gear is extended in this drawing section followed by the main and rear sections. The engine nacelle is shown in its normal and minimum clearance assembled position. Landing gear is shown extended and the plane is landed only on rear wheels. Other wing panels are the last to be assembled. Reference from: Aircraft Production.

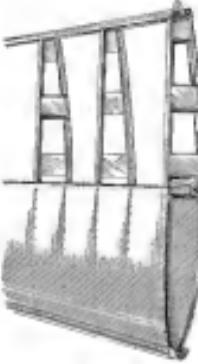
The North American B-52 nose wheel utilizes an hydraulic damper which is mounted vertically. This design, shown in "A", while "B" is broader, accommodates to restrict the angular movement of the wheel. However, by extracting a lever from the cockpit, the wheel may be permitted additional movement for difficult conditions. The hydraulic pressure must be lowered inside the ship at "C" and releases the wheel lock and allows it to rotate in either direction trapping



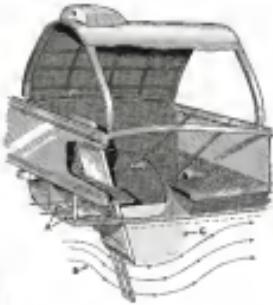
C Drawing Model 22 shows the gas tank well "A" below is a spherical chamber about 100 cubic feet located after fuselage. The tank which is mounted in this well is also made of 1000 stamped stainless steel welded, has a capacity of 14 cu. ft. A small tank of similar size is located in front of the main tank. Reference to drawing "B" are of steel and are used as the first objective only. They are used for shrinking the ring or the bearing sleeve by means of bolts and will later be strengthened in aluminum trapping



D Drawing Model 22 illustrates the gas tank well "A" below is a spherical chamber about 100 cubic feet located after fuselage. The tank which is mounted in this well is also made of 1000 stamped stainless steel welded, has a capacity of 14 cu. ft. A small tank of similar size is located in front of the main tank. Reference to drawing "B" are of steel and are used as the first objective only. They are used for shrinking the ring or the bearing sleeve by means of bolts and will later be strengthened in aluminum trapping



E A hatch shield in the Boeing B-17 is shown in exploded view so that a portion of the front postition below the top of the fuselage. Shown clearly showing the top of the hatch, the side of the hatch, and through which the nose gear is held without being blown completely off by the oxygen system. It shows the operating rod and the locking device. The downward deflected surface against the open door, and "G" is the rear panel of the hatch. The hatch is used for entering and removing parts of the aircraft. It is located in the rear fuselage just off of the observer's position and above in the rear cockpit. Reference from: Aircraft Production.





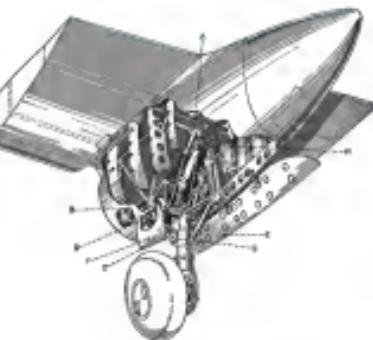
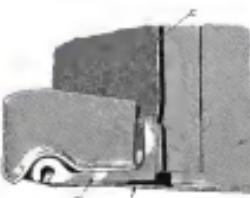
Uses **VICKERS** HYDROMOTIVE CONTROLS

The Vultee Vengeance Dive Bomber . . . like practically all other modern aircraft built in the United States . . . uses Vickers Hydromotive Equipment. These high pressure oil hydraulic controls are as widely used because they do their job dependably, smoothly and accurately . . . no matter how severe the service.

VICKERS Incorporated, 1802 KEEBLER BLVD., DETROIT, MICHIGAN



At right are shown landing gear details in the port nostril of the Douglas DB-7 light bomber. When the wheel is down, door "B" is closed. If it is held in the half open "W" position, the outward door "U" is held in the half open "W" position, the outward door "U" is opened through action of the rod "T" which is attached to both outward hinge fitting "W" and hinge "U" on the inward door. "E" is a locking gear mounting switch.



The wing aileron of the Douglas Aircraft "Skyline" is fitted around fold. The method of attaching this aileron is the distinctive aileron whip space and rib is worthy of notice. The outside edge of the aileron is "B", while one of the former ribs carries the bearing "C" and the other is bent back to form the base of the space in "A". As indicated in this sketch, when the outermost aileron rib angle "W" is hooked about front edge. The aileron arm is made with a stepped rear end and the loop inserted in the hole. Then through the loop is the rib, and inside the hole a metal wire is inserted thus securing the aileron. The covering is then carried back over the leading edge and along the top in a similar joint on the top.

In the Messerschmitt 109, the aileron bell structure (right) which is bolted to the rear spar by fittings "F", is shown. The aileron itself is built of two main parts, the ribs "U", "W" and nose bearing "E", are brought together. The four lower halves are bolted together, the upper being secured through small recesses provided for such and so that the lower two bear on the nose bearing "E" which is bolted directly to the rear spar.



**AIRCRAFT
SALTER 1940**
LI. VULTEE PLANE

GENERAL CONTROLS MULTI-POISED AIRCRAFT TYPE ELECTRIC VALVES



GENERAL CONTROLS
TYPE PVJ Multi-Poised Valve

SPECIALLY
DESIGNED
for use on
ENGINE
FIRING,
OIL DILUTION
and
CABIN HEATER
VALVES...

NOT AFFECTED BY VIBRATION WILL OPERATE IN ANY POSITION

General Controls Type PV Valves are two way compact electric valves designed specifically to obtain positive operation on aircraft oil and gasoline lines. Type PV-J Valve illustrated is particularly recommended for engine priming and oil dilution applications. Multi-Poised design assures operation in any position, under all flight conditions (no stationary magnetic valve will do this); operation is unaffected by vibration or acceleration. In substantial "lifespan," General Controls PV Valves are drop-proof—available water-proof. Power consumption is low; operates on DC. Operation is fast, free of sliding parts, hence suitable for highly viscous fluids. Construction is permanent. Available normally open or normally closed. Limited armature movement assures long life; no cause of magnetic break in both poles guards against failure due to magnetic residual. Write or wire today for complete engineering details and valves for inspection and test.

GENERAL CONTROLS

GENERAL CONTROLS, INC., THE LEADERSHIP
IN ELECTRIC VALVES
THE ALLEN AVENUE, GLENDALE, CALIFORNIA
GENERAL & NEW YORK • CHICAGO • ATLANTA • BIRMINGHAM • CINCINNATI
• BOSTON • BIRMINGHAM • PHILADELPHIA • BOSTON • NEW YORK

*Guaranteed
Forgings*



UNDER LABORATORY CONTROL

WYMAN-GORDON

WORCESTER, MASS. • HARVEY, ILLINOIS
DETROIT, MICH.

AIRCRAFT, January, 1940

Coming in February

FOR 100 THOUSANDS OF NEW PERSONS COMING IN FEBRUARY

...and the NEW THOUSANDS who are rallying to the industry
to SPEED THE VICTORY PROGRAM

AVIATION'S YEARBOOK

FACTS • FIGURES • PERSONNEL • PLANES • ENGINES • EQUIPMENT

THE 9th ANNUAL DIRECTORY NUMBER

AVIATION'S YEARBOOK remains essential, indispensable, up-to-the-minute working data required by all branches of aviation. Aviation's 9th Annual DIRECTORY NUMBER provides the latest information on thousands of aircraft, engines, equipment, personnel, and other subjects ever assembled in AVIATION DATA • SPECIFICATIONS • PRODUCT INFORMATION • PERSONNEL • EQUIPMENT in the nation's prime industry, aviation an American art war makes AVIATION'S YEARBOOK wholly valuable to the men of the aviation industry—and manufacturers whose products affect well now build America's air power.

PLANE—Detailed history of American and foreign. Old and modern aircraft discussed by photographs, drawings, tables, and figures. All types and classes and various specifications. Also aircraft specifications and detailed design info.

ENGINES—Complete specification for all engines. In addition to the 1000+ aircraft engines, many new aircraft engines and components also accompanied by complete material on optional engines in use.

MATERIALS—A monthly compilation of materials used in aircraft construction. Made up of progressive drawings and tables showing the use of new tools and special design techniques.

DATA—A monthly listing of vital facts and figures on the present flying transportation situation.

FAIRBANKS MOUNTAINS—A history of great land, timber, and mineral resources of the Alaska mountains.

AIRCRAFT AND ENGINE EQUIPMENT, PARTS AND MATERIALS—A monthly compilation of news items, topics described by type of product mentioned in the last column, listing will include company names, addresses, key personnel.

GRATED NUMBER OF COPIES PRINTED • AVIATION'S YEARBOOK TOOK

AVIATION MATERIALS, 800 West 42nd St., New York, N. Y.

90,000 copies were printed in 1939 and will be followed by February 1940. Price after \$10.00 per copy, less than 1000 copies \$10.00 each. \$10.00 includes cost of shipping.

Check here if you want to receive a copy of AVIATION'S YEARBOOK.

Check here if you want to receive a copy of AVIATION'S YEARBOOK.

Check here if you want to receive a copy of AVIATION'S YEARBOOK.

Check here if you want to receive a copy of AVIATION'S YEARBOOK.

Check here if you want to receive a copy of AVIATION'S YEARBOOK.

Reserve Your Copy

PRINT ORDER will exceed 10,000 copies.
On 1940, total ad
paid circulation of
AVIATION'S YEARBOOK
was \$234,000.

Name _____

City & State _____

Company _____

Address _____

MANUFACTURING

New Abrasive Stone Aids Production

By means of a new kind of bonding agent, called "Microspore-X-Rite," Mid-West Abrasive Co., Detroit, Mich. has developed a stone which is believed to offer a solution to many stone problems and to result in increased production.

One of the more important advances reported is the considerable lengthening of the time each stone can be used effectively and a resultant increase in the number of finished pieces per unit. It is said the new abrasives have shown an average single-life exceeding that of other type stones by more than 100 percent. In other words, seven to eight pieces are produced with Microspore-X-Rite, according to the firm, than are produced by other stones.

They are also said to be capable of faster work removal, producing 16 pieces in the same time required at necessity to produce three pieces with previous type stones.

Although playing but an inconspicuous part in the task of producing aircraft and aerospace engines, abrasives are of extreme importance in the heat analysis and in problems of reducing friction in engine bearing. Experimental has shown that the use of fiber and the possibility of such parts as bearing surfaces, sleeve cylinders, cylinder guides, bushings, crank shafts and pinions just depend to a great extent on the degree of smoothness and on their efficiency built into such parts prior to assembly. Engines charged with signature and producing higher-temperature gases are particularly susceptible to the effects of friction. Therefore, reducing friction is the study and development of abrasives and the tools necessary to apply them to metal surfaces.

Abrasives are obtainable in two types: bonded and unbonded. A varified bonded abrasive consists of thousands of minute abrasive grains held together by a bonding agent which is encased within a thin protective coating free "skins" of varying hardness.

Since each of these grains is an efficient cutting tool it is important first that they be of uniform size and, second, that the bonding agent holding them in place be of adequate strength so that the stone will wear evenly, thereby wearing any surface to which the surface being treated.

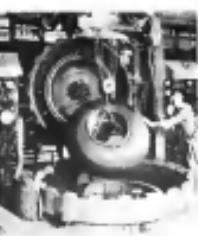
Bonding agents previously used in the manufacture of bonding stones had several obvious weaknesses. They were

either too "hard" or too "soft"; "hard" very little was known about ways to control either their hardness or grain structure. If the stones were too hard the grains would hold entirely too long thus causing them to "bind up" with amorphous metal chips from the work and, in the end, stop cutting. This condition is similar to a paper or sandpaper "bordel" with the difference it is supposed to remove and therefore having lost its abrasive effectiveness.

However the stone was too soft, it would not be durable, and, consequently, it would not necessarily remove the remaining portion of the stone to cut effectively.

Another fault of such stones was that they were too porous and absorbed too much of the coolant used on them. Consequently, too much of the metal removed from the work was deposited on the stone instead of being washed away by the coolant.

In order to eliminate all of these problems, a bonding agent must be hard enough to retain the abrasive grains firmly during their period of use, yet strong enough to release the grains before they exceed the "saturation" stage, namely enough to wear down evenly and not absorbent enough to prevent penetration of the coolant. In addition the stone should be effectively useful for a much longer period of time, because too frequent changes of setting are too costly in time and money. Mid-West's Microspore-X-Rite is made of such an enveloping matrix that each abrasive grain is completely embedded, anchored and supported in



Stabilizing the growing volume of T-7 Gooseneck (ie., a difficult boundary layer aerospace flow) now of a giant submarine. Weight 35 lb. with fins like those mentioned the is similar to those equipment. Considerable 4-metered RIAE facilities.

depends of others, assuming an even grain structure in the stone. The new agent, however, has extremely low absorption characteristics, absorbing less than one percent of its weight in coolant and thus helping to eliminate absorption of amorphous metal created by the stone.

Throughout the entire manufacturing process the Mid-West abrasives stones are made with precise specifications as to texture, pressure and heat treatment, thus ensuring both grain structure and hardness.

It is said stones are produced with a grain structure and hardness uniformly variance of less than one-eighth of a grade.

Another fault of such stones was that they were too porous and absorbed too much of the coolant used on them. Consequently, too much of the metal removed from the work was deposited on the stone instead of being washed away by the coolant.

In order to eliminate all of these problems, a bonding agent must be hard enough to retain the abrasive grains firmly during their period of use, yet strong enough to release the grains before they exceed the "saturation" stage, namely enough to wear down evenly and not absorbent enough to prevent penetration of the coolant. In addition the stone should be effectively useful for a much longer period of time, because too frequent changes of setting are too costly in time and money. Mid-West's Microspore-X-Rite is made of such an enveloping matrix that each abrasive grain is completely embedded, anchored and supported in

Landing tip through the tail work from an aircraft test cell showing how Fiberglas blades are mounted between metal sheets.

Fiberglas Quiets Roar in Test Cells

Using Fiberglas wool as sound aborbing material on the construction of effective sound stacks is reported at Paterson Field, Dayton, as well as at Cagin, T. I. and Midway Islands, two new bases now enjoying the distinction of being well up in the front in Japan's 12-armed war upon us.

Such stacks are regarded as must items from military bases. They are necessary to insulate aircraft engines from noise of a giant submarine. Warships 35 ft. with fins like those mentioned the is similar to those equipment. Considerable 4-metered RIAE facilities.

A test speed usually consists of a cell in which the engine is mounted, a test cell with walls directly connected to the test cell, and two sound stacks through which air enters and leaves the cell. The sound stacks serve as adabs and discharge air or put air into the cell at high velocity.

bility by the engine propeller, and all the time this insulation is a large percentage of the noise generated by the engine propeller or engine.

The stacks may be above the tail cell as they may be at the tail cell level. One typical installation employs vertical sound stacks about 40 ft. high with a 26 ft. square opening. In each stack space is provided for 15 stand absorbing panels, each measuring 20x20 ft. A horizontal stack about 30 ft. deep with a 45 ft. square opening provides space for 25 stand absorbing panels, each 20x20 ft.

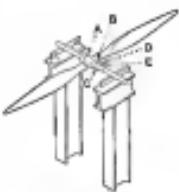
The requirements for the sound absorbing material used in the stacks are varied and exacting. It is claimed, however, that Fiberglas thermal insulation meets most of them.

The total process is to mount rolls of the Fiberglas material between perforated metal plates and lay them over a frame of angle iron, and then cut them to size, and finally to lay them in a mold. The press is insulated three inches thick, is about 4 ft. per cubic foot, and, when it is said to have a nose reduction coefficient of 0.9. Wind velocities of 100 mph are also said to be withstood by Fiberglas, and because it is inert, it resists the fumes from gasoline, lubricating oil and water vapor.

Because of the excellent peak strength of Fiberglas the panels may be easily assembled, it is claimed, and the extremely light weight of the material makes the panels easy to handle and install.

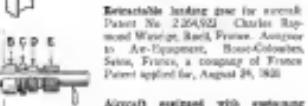
With this form of testing, it is said the stacks can be tested without dismantling, as any loose material "will" which, if properly tied to these off the patch testing. The device also has the advantages of convenient and quick adjustment of the propeller into testing position.

Adaptation of the device to propeller balancing stand is illustrated there.



and connected to the hub wherein a counter-rotating counterweight is used for both motors and a balance disk placed motor at mid-point and connected in series with the other two motors and operating as a fail-safe function.

Means for preventing or removing ice formation on airplane wings. Patent No. 2,784,267. William C. Clay, Buckner Beach, Virginia. Patent applied for, March 18, 1959.



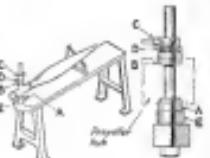
Aircraft equipped with waterproofing system. Patent No. 2,784,042. Charles Raymond Winge, St. Etienne, Auvergne to Av-Equipage, Rose-Goulette, Sain, France, a company of France. Patent applied for, August 26, 1959.

Propeller equipped with waterproofing system. Patent No. 2,784,043. George W. Toff, Wallace Grove, British Columbia to Autogiro Company of America, Wallace Grove, British Columbia. Description: A blade-mounted rotor incorporating insulation for insulating a blade on the rotor hub. Patent for, Oct. 8, 1958.

Blade mounting for aircraft suspensions systems. Patent No. 2,784,044. Guy G. Toff, Wallace Grove, British Columbia to Autogiro Company of America, Wallace Grove, British Columbia. Description: A blade mounting member for rotary winged aircraft. Patent applied for October 16, 1958.

Rotatable winged aircraft. Patent No. 2,784,045. Agnew F. Larson, Jenkins, Texas, Thomas A. Autogiro Company of America, Wallace Grove, British Columbia. Patent applied for, May 18, 1959.

Testing apparatus. Patent No. 2,784,046. Frank G. Marano, Dayton, Ohio. Description: A testing apparatus of the type which includes a rotatable hub provided with a compartment, with an adjustable lift-craft in the compartment; a valve and a valve-operating means carried by the hub and operatively connected thereto for inflating and deflating the lift-craft in relation to the rotation of the hub; and a means for remote operation of the valve-operating means. A desirable connection is between the valve-operating mechanism and rotating means. The valve-operating means are started by, and movable with, the valve-operating mechanism for an anti-aligning purpose; and a position is adopted in alignment with the direction of the operating force, whereby a maximum lift-craft separation of the valve-operating means serves to disconnect the gas from the lift-craft. Patent applied for, December 26, 1959.





Spots play tennis. Spots have been best to have one level of 6-8 cpl. Scouting may choose by 1/2 to 1 kg more when the horse. Speed is expressed by solving 1 times. Spots play in places more extensive because they can not be expected to play at the same time. Spots play quickly against a certain posture. Further expression of lever last. CGs also have body rhythm and best learned at lower reaches as long may be required and still expression of play is seen through the body. This is the reason why the first two years that we can still practice to expression of one lever. Developed several years ago by Tim Marlow and Tim Jenkins.

Bottle plate machines developed by Chas. Breyer for manufacturing Goudyloid and Bielek plates. Oscillating is done by belt-coupled disc oscillating wheel running at opposite directions. Upper disc travels vertically; pressure applied by a piston sustained in a frame as shell plates until pressure built up by a spring on upper spindle. Lower spindle is adjustable so as to bring lower plates due to weight stored up to bottle-plate rest and quick rest. Both surfaces of plate may present in one oscillation.

As most 3-wheeler racing teams at D-GC-3 have long periods of work to do in preparing, their spudger is powered with a balance variable speed direct drive motor which develops up to 5 hp which will move right on and stop quickly. The rear wheel has a maximum speed of 1400 rpm. Gearing is all standard and includes the variable speed driving motor. Vacuum drive and clutches are available for quickly connecting any necessary to driving spudger. Left section of plumb body contains a vacuum pump. Right section contains a vacuum pump, a vacuum tank and compressed air tank. The rear wheel is a 16" diameter, 3-spoke magnesium wheel. On the front are solid magnesium wheels. Spudger can mount front wheel from any type of motorcycle, but has special mounts for spudger. Rear wheel is a 16" diameter wheel. It is an excellent team, but a medium-sized shop.

overhead, machine shop, stock room, receiving and shipping, propeller overhead, paint shop and instrument overhead.

On the opposite 170 ft. side of the hangar building is a two story office building, 25 ft. wide. The upper floor of this section is used for Flight Operations, Meteorology, Reservations and a class room for schooling. The lower floor is taken up by Commodity storage, Radio Service and overhaul, and offices of Superintendents of Maintenance, Engineering and Communications.

The distribution of preference points over the system is as follows with work performed by each:

Chicago: 4 routine turn-around inspections involving receiving and departing of 4 flights daily. Average by time over, 3 hours. 1 routine daily inspection involving receiving one flight complete, cleaning of the airplane ready and on, complete daily flight inspection and departing this aircraft. 6½ hours by average time is permitted for this work. Maintenance personnel 12, community personnel: 5.

St. Louis Line service of 8 Engs
daily. Maintenance personnel 4
Jackson Line service of 6 Engs

Growth of Chinese & Southern Mainland Tech

Year	Number of Planes	Flight Hours Per Month	Number Personnel	Airplanes
1934	2	100	30	Bellanca
1935	5	1000	50	Spartan
1936	4	720	30	Lockheed
1938	5	1000	40	Lockheed
1940	8	10,000	80	Douglas
1941	6	1400	90	Douglas

美国司法部 - Justice - USA

Eaglets Soaring into the Skies *... by thousands!*



WELL AHEAD of its program to train thousands of pilots each year, the Army Air Corps is graduating flying cadets at civilian contract flying schools.

These eager young men are entitled to, and actually have, the best of everything — in training, living accommodations, equipment, and of course, Texaco Aviation Gasoline and Texaco Aircraft Diesel Oil.

And with the commercial oilfields...
More reservoirs under miles in the U.S. are
found with Texaco than with any other brand.
The outstanding performance that has made Texaco FIRST
with the refiners has made it FIRST in the fields based on
the gulf.

A Texaco Aviation Frequency will gladly cooperate in the selection of Texaco Aviation Products, available at leading airports in the 48 States.

Please the nearest Texaco distributor point, or write:
The Texaco Company, Aviation Division, 125 East 42nd
Street, New York, N. Y.



TEXACO Lubricants and Fuels
FOR THE AVIATION INDUSTRY

卷之三

本节由黄士君 - [黄士君](#) 整理

四

111

MAINTENANCE

Overhaul of airplanes, engines, propellers, engine accessories, radio (both ground station and airplane), instruments and all station equipment. Personnel: Maintenance: 66. Commissary: 2.

Total Maintenance and commissary personnel: 119.

All Routine and Periodic inspection and services are done at night and all overhaul work done on day shifts. This makes possible the operation of the present service with the least disruption that would be possible with a Periodic Service down during the day.

The maintenance set up at a nuclear site will reflect such as CMS requires unavoidable necessity on the part of all personnel in keeping up equipment and procedures on the various phases of service and overhaul, so as to keep the investment in maintenance equipment in ratio with the expected outage.

One aircraft will be available by month. It is used at a time and 11/2 hour periods engine changes and preventive maintained by the day crew. There are 2 spare engines, complete with all required accessories.

Other spare equipment consists of the following:

4 engine nacelles, complete with all cooling, 4 Hydroscopic propellers, 4 Main landing wheels complete with all necessary units, 2 sets of aeroplane control surfaces, 1 set of landing gear and retracting unit, 2 sets of aeroplane landing flaps, 8 unseated flight panels, ethofluorocane aeroplane and engine sc

cessories needed for protection in emergency and exchange on programmed overhaul.

Present overhaul period on engines, propellers and engine accessories is 600 flying hours, with approximately being able to go all the way to the double 1200 hour Periodic Service and Inspection, they are changed at the half way mark for convenience.

The Log Club has charge of keeping all aeroplane and engine logs as well as changing aeroplane periodic service and overhaul functions. They always operations on the proper costing of air.

(Turn to page 381)

Rack hardware and its engines receive a Bi-monthly inspection daily, and a Periodic



This propeller blade balancing fixture was designed for holding blades for accurate balancing and loading. Flanged bracket and counter weight arm permit holding of blades by arms. Weight blade is secured to the left side of the fixture and the counter weight arm is released to hold the blade during the counterbalance. Other two blades are then dressed to match the first blade. This method reduces time required for blade balance on the balancing stand. Fixture was worked out by Robert Miller.



With eight instruments now assembled on a separate panel each of sections are interlocked to make a quick change of entire panel which is removed every 12 hours. 10 sets is required for the change. These items were used. Don Johnson is shown (far right) Don Johnson is shown (far right) holding the panel.



A corner of the instrument shop with Don Johnson at right and John Rynd at left. Johnson handles portable hand tools while Rynd handles heavy power tools. These features in creating a voltage regulator used in aircraft fuel gauge circuit.



Working in a wheel well is usually a process which at times conflicts with the need, fitted with two heavy heat strips that heat around the wheel well. One of these heat strips can be held on a well wheel and is used. It was developed just half hour



Maintenance Department fixtures are used this balancing equipment is an old machine shop in New York. Rotating base was set with three holes. A vertical base of steel was mounted to G & B and fastened in the horizontal frame.



FEDERAL Aircraft BEARINGS

PRECISION AND ACCURACY are brought to their highest state of perfection in Federal Aircraft Bearings. Every step in manufacture is carefully supervised and checked with the result that each ball bearing is capable of sustaining the Federal reputation for **QUALITY**.

THE FEDERAL BEARINGS CO., INC.
Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

Denver Office: 2610 Rock Tower • Cleveland Office: 400 Sessions Building
Chicago Office: 922 S. Wabash Ave. • Los Angeles Office: 5410 Wilshire Blvd.

Motorola AND R-B-M HAVE COMBINED TO MAKE A VITAL DEFENSE PRODUCT

CALVIN INC. CORP.
Motorola

R-B-M PLANT



FOR YEARS R-B-M engineers and production experts have specialized in the development and production of Relays, Solenoids, Switches and other small electrical and mechanical devices. When Motorola selected knowns of its highly skilled engineering staff and lever plant facilities, let R-B-M Engineers make recommendations on your particular problem.



Minnesota FM Model Transmitters and Receivers are built at the factory for National Defense. They are used for two-way communication in defense plants throughout the U. S. Mechanical equipment, like Home Defense, they serve fire, medicine and police departments. Minnesota was R-B-M Relays in this vital defense program.

R-B-M MANUFACTURING CO.
Division of
ESSEX WIRE CORPORATION
LOGANSPORT, INDIANA

TYPE 30 RELAY



The NEW WORTHINGTON "Grass Blitzer"

Solves Airport Mowing Problems —
Enables you to cut large acreage at
sustained high speeds

In order to "Keep 'em Flying," the vast grass acreage of our country's airports must be constantly kept to proper height. Since ordinary grass mowers have been found fast enough to do this job efficiently, Worthington engineers, who were the first to develop the power-mowing principle for Golf Courses, Park Departments, Prestige Estates and Highways, have produced the new "Grass Blitzer" as their contribution to Defense. • The new Cutting Units, developed on an entirely new principle from the knowledge and experience gained through 30 years of building the finest and most efficient turf maintenance equipment, eliminate all usual contact with the ground through rollers or cutters and permit high-speed cutting with smoothness of "ride" that prevents wear, misalignment, and breakage. • Only the large pneumatic tire of the ground wheels touch the ground. • Contractors have proved that the Worthington Airfield Grass Blitzer with 5 units of 20 miles per hour has a capacity of 66 acres per hour including distance of 15-inch strip for overlap. • For Airports the Worthington Grass Blitzer is the fastest, most efficient unit ever produced.

Write today for complete information
and detailed specifications.

WORTHINGTON MOWER COMPANY

MAIN OFFICE: STRONGSBURG, PA.
SALES AGENCIES: ALL PRINCIPAL CITIES



SAVE MONEY QUICKLY

with these Low-Cost Abrasive Belt

Finishing Machines

Our manufacturer stepped up production 600%!

There's a place to your shop to reduce costs and save money with this Delta "E" Abrasive Finishing Machine. It's heavy and sturdy enough to handle the most severe finishing and polishing operations in your shop—and yet is portable enough for even the most compact of spaces. Many shops are using this machine for polishing and sizing metal parts. It's also perfect for working plastics (acrylics, plexiglass) production was increased 600% by the use of this Delta machine!

Manufacturers also use it as a finishing and polishing machine with a speed setting in power tool over larger machines. For example, finishing and polishing plastic parts, it has found wide acceptance. Many shops have used combinations of this unit to make up unusual machines or a quick setting. It's adaptable for practically any small industrial finishing operation.



Completely Enclosed— Toughly Guarded

Delta's newest addition to the family of Delta tools is the Abrasive Finishing Machine. This unit, resembling like the other units, may be powered in a moment for use in finishing long materials or curved work. Unique plate surfaces also increase the efficiency of this unusual system.

Completely Ball-Bearing Equipped

Designed because "selected at the factory."

SEND FOR FULL DETAILS

For complete specifications and low prices on Delta Abrasive Belt Finishing Machines send coupon below for latest Delta Catalog.



100 E. Wisconsin Ave.
Milwaukee 2, Wisconsin
Sole Distributor. Please send me the latest Delta Catalog and information on the new Delta Abrasive Finishing Machine and other fine new tools you offer. I am a member of the Delta Club.

Name _____

Address _____



factory. Its rubber mounting required no frame for vibration, one more of its unusual features. Adjustable deflection or drum head enables practically all drum heads to be provided with each unit speed. This includes many standard sizes, as well as special sizes, including a three-blade head for either flat or bar including 14" square. It can be used successfully in conjunction with the 2½" x 16½" Abrasive Belts made by the shop. Cloth belts are available in 14", 16", 18", 20", 22", 24", 26", 28", 30", 32", 34", 36", 38", 40", 42", 44", 46", 48", 50", 52", 54", 56", 58", 60", 62", 64", 66", 68", 70", 72", 74", 76", 78", 80", 82", 84", 86", 88", 90", 92", 94", 96", 98", 100", 102", 104", 106", 108", 110", 112", 114", 116", 118", 120", 122", 124", 126", 128", 130", 132", 134", 136", 138", 140", 142", 144", 146", 148", 150", 152", 154", 156", 158", 160", 162", 164", 166", 168", 170", 172", 174", 176", 178", 180", 182", 184", 186", 188", 190", 192", 194", 196", 198", 200", 202", 204", 206", 208", 210", 212", 214", 216", 218", 220", 222", 224", 226", 228", 230", 232", 234", 236", 238", 240", 242", 244", 246", 248", 250", 252", 254", 256", 258", 260", 262", 264", 266", 268", 270", 272", 274", 276", 278", 280", 282", 284", 286", 288", 290", 292", 294", 296", 298", 300", 302", 304", 306", 308", 310", 312", 314", 316", 318", 320", 322", 324", 326", 328", 330", 332", 334", 336", 338", 340", 342", 344", 346", 348", 350", 352", 354", 356", 358", 360", 362", 364", 366", 368", 370", 372", 374", 376", 378", 380", 382", 384", 386", 388", 390", 392", 394", 396", 398", 400", 402", 404", 406", 408", 410", 412", 414", 416", 418", 420", 422", 424", 426", 428", 430", 432", 434", 436", 438", 440", 442", 444", 446", 448", 450", 452", 454", 456", 458", 460", 462", 464", 466", 468", 470", 472", 474", 476", 478", 480", 482", 484", 486", 488", 490", 492", 494", 496", 498", 500", 502", 504", 506", 508", 510", 512", 514", 516", 518", 520", 522", 524", 526", 528", 530", 532", 534", 536", 538", 540", 542", 544", 546", 548", 550", 552", 554", 556", 558", 560", 562", 564", 566", 568", 570", 572", 574", 576", 578", 580", 582", 584", 586", 588", 590", 592", 594", 596", 598", 600", 602", 604", 606", 608", 610", 612", 614", 616", 618", 620", 622", 624", 626", 628", 630", 632", 634", 636", 638", 640", 642", 644", 646", 648", 650", 652", 654", 656", 658", 660", 662", 664", 666", 668", 670", 672", 674", 676", 678", 680", 682", 684", 686", 688", 690", 692", 694", 696", 698", 700", 702", 704", 706", 708", 710", 712", 714", 716", 718", 720", 722", 724", 726", 728", 730", 732", 734", 736", 738", 740", 742", 744", 746", 748", 750", 752", 754", 756", 758", 760", 762", 764", 766", 768", 770", 772", 774", 776", 778", 780", 782", 784", 786", 788", 790", 792", 794", 796", 798", 800", 802", 804", 806", 808", 810", 812", 814", 816", 818", 820", 822", 824", 826", 828", 830", 832", 834", 836", 838", 840", 842", 844", 846", 848", 850", 852", 854", 856", 858", 860", 862", 864", 866", 868", 870", 872", 874", 876", 878", 880", 882", 884", 886", 888", 890", 892", 894", 896", 898", 900", 902", 904", 906", 908", 910", 912", 914", 916", 918", 920", 922", 924", 926", 928", 930", 932", 934", 936", 938", 940", 942", 944", 946", 948", 950", 952", 954", 956", 958", 960", 962", 964", 966", 968", 970", 972", 974", 976", 978", 980", 982", 984", 986", 988", 990", 992", 994", 996", 998", 1000", 1002", 1004", 1006", 1008", 1010", 1012", 1014", 1016", 1018", 1020", 1022", 1024", 1026", 1028", 1030", 1032", 1034", 1036", 1038", 1040", 1042", 1044", 1046", 1048", 1050", 1052", 1054", 1056", 1058", 1060", 1062", 1064", 1066", 1068", 1070", 1072", 1074", 1076", 1078", 1080", 1082", 1084", 1086", 1088", 1090", 1092", 1094", 1096", 1098", 1100", 1102", 1104", 1106", 1108", 1110", 1112", 1114", 1116", 1118", 1120", 1122", 1124", 1126", 1128", 1130", 1132", 1134", 1136", 1138", 1140", 1142", 1144", 1146", 1148", 1150", 1152", 1154", 1156", 1158", 1160", 1162", 1164", 1166", 1168", 1170", 1172", 1174", 1176", 1178", 1180", 1182", 1184", 1186", 1188", 1190", 1192", 1194", 1196", 1198", 1200", 1202", 1204", 1206", 1208", 1210", 1212", 1214", 1216", 1218", 1220", 1222", 1224", 1226", 1228", 1230", 1232", 1234", 1236", 1238", 1240", 1242", 1244", 1246", 1248", 1250", 1252", 1254", 1256", 1258", 1260", 1262", 1264", 1266", 1268", 1270", 1272", 1274", 1276", 1278", 1280", 1282", 1284", 1286", 1288", 1290", 1292", 1294", 1296", 1298", 1300", 1302", 1304", 1306", 1308", 1310", 1312", 1314", 1316", 1318", 1320", 1322", 1324", 1326", 1328", 1330", 1332", 1334", 1336", 1338", 1340", 1342", 1344", 1346", 1348", 1350", 1352", 1354", 1356", 1358", 1360", 1362", 1364", 1366", 1368", 1370", 1372", 1374", 1376", 1378", 1380", 1382", 1384", 1386", 1388", 1390", 1392", 1394", 1396", 1398", 1400", 1402", 1404", 1406", 1408", 1410", 1412", 1414", 1416", 1418", 1420", 1422", 1424", 1426", 1428", 1430", 1432", 1434", 1436", 1438", 1440", 1442", 1444", 1446", 1448", 1450", 1452", 1454", 1456", 1458", 1460", 1462", 1464", 1466", 1468", 1470", 1472", 1474", 1476", 1478", 1480", 1482", 1484", 1486", 1488", 1490", 1492", 1494", 1496", 1498", 1500", 1502", 1504", 1506", 1508", 1510", 1512", 1514", 1516", 1518", 1520", 1522", 1524", 1526", 1528", 1530", 1532", 1534", 1536", 1538", 1540", 1542", 1544", 1546", 1548", 1550", 1552", 1554", 1556", 1558", 1560", 1562", 1564", 1566", 1568", 1570", 1572", 1574", 1576", 1578", 1580", 1582", 1584", 1586", 1588", 1590", 1592", 1594", 1596", 1598", 1600", 1602", 1604", 1606", 1608", 1610", 1612", 1614", 1616", 1618", 1620", 1622", 1624", 1626", 1628", 1630", 1632", 1634", 1636", 1638", 1640", 1642", 1644", 1646", 1648", 1650", 1652", 1654", 1656", 1658", 1660", 1662", 1664", 1666", 1668", 1670", 1672", 1674", 1676", 1678", 1680", 1682", 1684", 1686", 1688", 1690", 1692", 1694", 1696", 1698", 1700", 1702", 1704", 1706", 1708", 1710", 1712", 1714", 1716", 1718", 1720", 1722", 1724", 1726", 1728", 1730", 1732", 1734", 1736", 1738", 1740", 1742", 1744", 1746", 1748", 1750", 1752", 1754", 1756", 1758", 1760", 1762", 1764", 1766", 1768", 1770", 1772", 1774", 1776", 1778", 1780", 1782", 1784", 1786", 1788", 1790", 1792", 1794", 1796", 1798", 1800", 1802", 1804", 1806", 1808", 1810", 1812", 1814", 1816", 1818", 1820", 1822", 1824", 1826", 1828", 1830", 1832", 1834", 1836", 1838", 1840", 1842", 1844", 1846", 1848", 1850", 1852", 1854", 1856", 1858", 1860", 1862", 1864", 1866", 1868", 1870", 1872", 1874", 1876", 1878", 1880", 1882", 1884", 1886", 1888", 1890", 1892", 1894", 1896", 1898", 1900", 1902", 1904", 1906", 1908", 1910", 1912", 1914", 1916", 1918", 1920", 1922", 1924", 1926", 1928", 1930", 1932", 1934", 1936", 1938", 1940", 1942", 1944", 1946", 1948", 1950", 1952", 1954", 1956", 1958", 1960", 1962", 1964", 1966", 1968", 1970", 1972", 1974", 1976", 1978", 1980", 1982", 1984", 1986", 1988", 1990", 1992", 1994", 1996", 1998", 1999", 2000", 2001", 2002", 2003", 2004", 2005", 2006", 2007", 2008", 2009", 2010", 2011", 2012", 2013", 2014", 2015", 2016", 2017", 2018", 2019", 2020", 2021", 2022", 2023", 2024", 2025", 2026", 2027", 2028", 2029", 2030", 2031", 2032", 2033", 2034", 2035", 2036", 2037", 2038", 2039", 2040", 2041", 2042", 2043", 2044", 2045", 2046", 2047", 2048", 2049", 2050", 2051", 2052", 2053", 2054", 2055", 2056", 2057", 2058", 2059", 2060", 2061", 2062", 2063", 2064", 2065", 2066", 2067", 2068", 2069", 2070", 2071", 2072", 2073", 2074", 2075", 2076", 2077", 2078", 2079", 2080", 2081", 2082", 2083", 2084", 2085", 2086", 2087", 2088", 2089", 2090", 2091", 2092", 2093", 2094", 2095", 2096", 2097", 2098", 2099", 20100", 20101", 20102", 20103", 20104", 20105", 20106", 20107", 20108", 20109", 20110", 20111", 20112", 20113", 20114", 20115", 20116", 20117", 20118", 20119", 20120", 20121", 20122", 20123", 20124", 20125", 20126", 20127", 20128", 20129", 20130", 20131", 20132", 20133", 20134", 20135", 20136", 20137", 20138", 20139", 20140", 20141", 20142", 20143", 20144", 20145", 20146", 20147", 20148", 20149", 20150", 20151", 20152", 20153", 20154", 20155", 20156", 20157", 20158", 20159", 20160", 20161", 20162", 20163", 20164", 20165", 20166", 20167", 20168", 20169", 20170", 20171", 20172", 20173", 20174", 20175", 20176", 20177", 20178", 20179", 20180", 20181", 20182", 20183", 20184", 20185", 20186", 20187", 20188", 20189", 20190", 20191", 20192", 20193", 20194", 20195", 20196", 20197", 20198", 20199", 201200", 201201", 201202", 201203", 201204", 201205", 201206", 201207", 201208", 201209", 201210", 201211", 201212", 201213", 201214", 201215", 201216", 201217", 201218", 201219", 201220", 201221", 201222", 201223", 201224", 201225", 201226", 201227", 201228", 201229", 201230", 201231", 201232", 201233", 201234", 201235", 201236", 201237", 201238", 201239", 201240", 201241", 201242", 201243", 201244", 201245", 201246", 201247", 201248", 201249", 201250", 201251", 201252", 201253", 201254", 201255", 201256", 201257", 201258", 201259", 201260", 201261", 201262", 201263", 201264", 201265", 201266", 201267", 201268", 201269", 201270", 201271", 201272", 201273", 201274", 201275", 201276", 201277", 201278", 201279", 201280", 201281", 201282", 201283", 201284", 201285", 201286", 201287", 201288", 201289", 201290", 201291", 201292", 201293", 201294", 201295", 201296", 201297", 201298", 201299", 201300", 201301", 201302", 201303", 201304", 201305", 201306", 201307", 201308", 201309", 201310", 201311", 201312", 201313", 201314", 201315", 201316", 201317", 201318", 201319", 201320", 201321", 201322", 201323", 201324", 201325", 201326", 201327", 201328", 201329", 201330", 201331", 201332", 201333", 201334", 201335", 201336", 201337", 201338", 201339", 201340", 201341", 201342", 201343", 201344", 201345", 201346", 201347", 201348", 201349", 201350", 201351", 201352", 201353", 201354", 201355", 201356", 201357", 201358", 201359", 201360", 201361", 201362", 201363", 201364", 201365", 201366", 201367", 201368", 201369", 201370", 201371", 201372", 201373", 201374", 201375", 201376", 201377", 201378", 201379", 201380", 201381", 201382", 201383", 201384", 201385", 201386", 201387", 201388", 201389", 201390", 201391", 201392", 201393", 201394", 201395", 201396", 201397", 201398", 201399", 201400", 201401", 201402", 201403", 201404", 201405", 201406", 201407", 201408", 201409", 201410", 201411", 201412", 201413", 201414", 201415", 201416", 201417", 201418", 201419", 201420", 201421", 201422", 201423", 201424", 201425", 201426", 201427", 201428", 201429", 201430", 201431", 201432", 201433", 201434", 201435", 201436", 201437", 201438", 201439", 201440", 201441", 201442", 201443", 201444", 201445", 201446", 201447", 201448", 201449", 201450", 201451", 201452", 201453", 201454", 201455", 201456", 201457", 201458", 201459", 201460", 201461", 201462", 201463", 201464", 201465", 201466", 201467", 201468", 201469", 201470", 201471", 201472", 201473", 201474", 201475", 201476", 201477", 201478", 201479", 201480", 201481", 201482", 201483", 201484", 201485", 201486", 201487", 201488", 201489", 201490", 201491", 201492", 201493", 201494", 201495", 201496", 201497", 201498", 201499", 201500", 201501", 201502", 201503", 201504", 201505", 201506", 201507", 201508", 201509", 201510", 201511", 201512", 201513", 201514", 201515", 201516", 201517", 201518", 201519", 201520", 201521", 201522", 201523", 201524", 201525", 201526", 201527", 201528", 201529", 201530", 201531", 201532", 201533", 201534", 201535", 201536", 201537", 201538", 201539", 201540", 201541", 201542", 201543", 201544", 201545", 201546", 201547", 201548", 201549", 201550", 201551", 201552", 201553", 201554", 201555", 201556", 201557", 201558", 201559", 201560", 201561", 201562", 201563", 201564", 201565", 201566", 201567", 201568", 201569", 201570", 201571", 201572", 201573", 201574", 201575", 201576", 201577", 201578", 201579", 201580", 201581", 201582", 201583", 201584", 201585", 201586", 201587", 201588", 201589", 201590", 201591", 201592", 201593", 201594", 201595", 201596", 201597", 201598", 201599", 2015100", 2015101", 2015102", 2015103", 2015104", 2015105", 2015106", 2015107", 2015108", 2015109", 2015110", 2015111", 2015112", 2015113", 2015114", 2015115", 2015116", 2015117", 2015118", 2015119", 2015120", 2015121", 2015122", 2015123", 2015124", 2015125", 2015126", 2015127", 2015128", 2015129", 2015130", 2015131", 2015132", 2015133", 2015134", 2015135", 2015136", 2015137", 2015138", 2015139", 2015140", 2015141", 2015142", 2015143", 2015144", 2015145", 2015146", 2015147", 2015148", 2015149", 2015150", 2015151", 2015152", 2015153", 2015154", 2015155", 2015156", 2015157", 2015158", 2015159", 2015150", 2015151", 2015152", 2015153", 2015154", 2015155", 2015156", 2015157", 2015158", 2015159", 2015160", 2015161", 2015162", 2015163", 2015164", 2015165", 2015166", 2015167", 2015168", 2015169", 2015170", 2015171", 2015172", 2015173", 2015174", 2015175", 2015176", 2015177", 2015178", 2015179", 2015180", 2015181", 2015182", 2015183", 2015184", 2015185", 2015186", 2015187", 2015188", 2015189", 2015190", 2015191", 2015192", 2015193", 2015194", 2015195", 2015196", 2015197", 2015198", 2015199", 2015200", 2015201", 2015202", 2015203", 2015204", 2015205", 2015206", 2015207", 2015208", 2015209", 2015210", 2015211", 2015212", 2015213", 2015214", 2015215", 2015216", 2015217", 2015218", 2015219", 2015220", 2015221", 2015222", 2015223", 2015224", 2015225", 2015226", 2015227", 2015228", 2015229", 2015230", 2015231", 2015232", 2015233", 2015234", 2015235", 2015236", 2015237", 2015238", 2015239", 2015240", 2015241",

Ryannews Flash

Training superiority. No other primary trainer is as maneuverable as the Ryan. Invariably it is tops. For equal flying time, students trained in Ryan have superior piloting skill. Graduates are as precise and ground handling is as smooth; teaching one section in static winds which ground others.

Flight training. Ryan trainers use 1/2 less gas and all the same types. Extreme ruggedness or construction and complete interchangeability keep costs at a minimum. **Maintenance.** Just about anyone can make adjustments. Based on years of experience with Ryan Trainers now incorporated into design, the Ryan is the answer to the question of "How?"

Ryan news flash. Because ground-handling is practically non-existent with a Ryan, repairs from this cause are almost eliminated. When they do occur, Ryan designs do not damage wing structure, and they are repaired requiring next of frequent recurring.

Design. All Ryan Trainers are under construction. In current production, 100 aircrafts are being delivered to students and instructors, after receiving extensive protection to the U.S. Army Air Corps, U.S. Navy and Foreign Governments.

RYAN AIRCRAFT CO., LINDBERGH FIELD, SAN FRANCISCO, CALIFORNIA

A line-up of Ryan N.R. Primary Trainers at the U.S. Naval Air Station, Jacksonville, Florida. Official U.S. Navy Photograph.

a box wrench is needed, with the additional locking feature enabling the user to open nuts on or off without attachment to a portion or metal for help to hold the tool. Available either single or in sets of three. *Fire-News, January, 1942.*

Jigges Soldering Unit

A new product, Jigges should have appeal to all electronics, thermel service and maintenance men and manufacturers of electrical equipment. By Jigges Inc., 23 W. Adams St., Chicago, Ill., each Jigges is a sturdy self-contained



soldering iron having just the necessary tension of 30 to 35 millibars and flux conveniently coated within a spring-wound heating jacket over the iron shell. To obtain a clean, perfectly soldered electrical connection, it is only necessary to push the wire into the jaws, turn the handle and dip the heated jaws in the Jigges as shown.

The shell guides and protects the power transformer to few solder into the jaws. Each shell is thus dropped onto the jaws, permits perfectly uniform solder and to be removed.

The jaws are designed to fit into the jaws. Each shell is thus dropped onto the jaws, permits perfectly uniform solder and to be removed.

and to be removed.

When squared away the top of the Jigges disappears into the top of the handle.

Steel Frame Aircraft Harness. 1625 M. McNichols Rd., Denver, Colo. These harnesses are said to be capable of withstanding practically all loads of aviation and space gear without failure. Maximum load of suspension harness is 100 lbs. weight, while the safety harness is 150 lbs. weight. Weight of harness is 1 lb. Each harness is a welded bridge type, usually inverted as an airplane. Roof is flat so that it has been tested to 1000 lbs. and can carry a maximum weight of 1000 lbs. and is reinforced with wire for additional strength. The covering may be fastened with a five-circumferent safety buckle. Straps are also of canvas pre-ply and are made of 100% cotton. The safety harness which may be easily and rapidly opened or closed. When squared away the top of the harness disappears into the top of the handle.

Fire-News, January, 1942.

the fact that the location of the point of application of the torch can be changed through adjusting the panel mounting, according to the company. These kits are on panel mounting brackets, which are available in two sizes. Two are used to position the torch on the panel as stand, and the third locks the assembly in place. Different lengths of plenum are available. Type M-24 is for 16 in. overall length, M-25 is 18 in. overall and M-26 is 20 in. overall. Type M-27 is a hybrid handle. It is mounted on a panel and a long handle. *Aviation, January, 1942.*

Micro Switch Actuator

Designed primarily for aircraft a new Micro Switch Actuator, Type "M" is being developed for pressure control. It has not been announced by Micro Switch Corp., Freeport, Ill. Many applications are possible because of the compactness of the assembly. The pressure actuator is provided with a lever and individual switch at low cost. Made by

Bee-Line Press

A new 125-ton mechanical hydraulic press is offered to the avionics industry by The Bee-Line Co., Indianapolis, Ind. A powerful unit, unit is mounted on a massive roller bearing carriage which permits a rapid rate of travel. The press is 10 ft. 6 in. wide, 10 ft. 6 in. high, 10 ft. 6 in. deep and weighs 100 tons. The press carriage can be raised or lowered 14 in. with a minimum space between rail and bed of 2 in., and maximum space of 26 in. between rail and top of carriage. It can exert a maximum pressure of 125 tons and less. Overall dimensions are length 8 ft., width 4 ft. 6 in.—*Aviation, January, 1942.*

Sunnen Precision Hoses

Precision fitting methods for internal bonding are applied by Sunnen Products Co., 1942 Massachusetts Ave., St. Louis, Mo. The Sunnen Precision Hose ensures flexibility as well as tight internal bond of hose and fixture. It need not be easily held by without risk of breaking because of lack of support.





The Brewster B-239 aircraft has been selected for the Brewster contract.

Brewster Finds a Way to Cut Costly Assembly Hours

One of the greatest problems of the aerautical engineer continues to be the development of new ways to speed up production. In casting present day demands Brewster Engineers cut assembly time with Boots Self-Locking Nuts. On the Brewster Buccaneer, a special nut especially known as the Boots "Rivet Saver," particularly, is performing a time-saving func-

tion. This rivet-like nut is engineered to fit the particular job.

Because they are demonstrably lighter, Boots Self-Locking Nuts save weight. And they are permanent. They literally "fitlike the plane."

Boots are the only one-piece, all-metal self-locking nuts to pass the rigid tests of Army, Navy and the Civil Aeronautics Authority.



Boots Self-Lock Nut

BOOTS

AIRCRAFT NUT CORPORATION
NEW CANAAN, CONNECTICUT

ons, major slowdown and wait, condense, and, in addition, produce super-sounds louder. It is said, military intelligence wireless can produce over the wave when only a few hours pass. The new device is also reported to have released large, massive mineral grades for other work—January 1941.

Scherr Snap Gages

Atlanta Adjustable Limit Snap Gages, manufactured in the U.S. in accordance with American gauge design standards, have been announced by General Beiter Co., 1000 Peachtree St., Atlanta, Ga., and New York, N.Y. Adjustable gage frames are made of Mechanics Castings instead of ordinary gray iron. The frame is a special metal selected because of its high tensile strength and which retains an original form without warping or straining. The



frame permits use of standard-size electrodes up to 1/8 in. in diameter and an overall size of 10 1/4 in. Length is horizontally measured to insure efficient lubrication and to avoid excessive load on the gage frame. The snap jaws are hardened steel plates ground against open jaws to furnish wear-resistance. January 1941.



are manufactured in two standard types, Model "A," made from graphite business and Model "C," made with solid black and two carbon woods and are now made in 30 different sizes.—January 1941.

"Rapid" Plastic Hammers

Especially designed for construction and repair of metal aircraft and developed in conjunction with one of the leading aircraft manufacturers, these new line of plastic hammers in being offered by Rapid Mfg. Co., Glendale, Calif., built to replace leather mallets and metal hammers in the new aircraft tools will not split wood or splinter metal. At less than \$1.00 each, Rapid hammers have replaced wood tips of previous model under P-51B. The handles are mounted by keyless bearing in weight

NEW EQUIPMENT

operations from 20 to 200 percent depending on nature of the work, has been announced by Metal Specialties Co., 19 1/2 Marion St., Cincinnati, 12, called the "Air-Clamp," a new device which may still prove having a potential value and is quickly mounted by means of a threaded collar which clamps in any desired position. The working head is mounted on a horizontal base with a wheel which slides on a slot on the center pillar. Two hand levers hold head in any position so that pressure may be applied in any direction and at any point on the work, regardless of size or shape within the capacity of the clamp. In its present form, the Air-Clamp offers a 2 1/2" radius on upper left side of working head. A lock control is available for certain types of operations. The



"Air-Clamp" is used to quickly hold components securely eliminating 20 and more setup costs.—January 1941.

Accessing Precision Switch

Something new in precision switches, the Accessing is offered by Aervac Electronic, 3005 Fulton Rd., Cleveland, Ohio, which is used to remote a small number of electrical components to control aircraft servos and power take-off devices. Long service under continuous vibration and exposure to severe air pressure make other outstanding features. In fact, it is used in aircraft where there are no access ports or new ports and forms of approaches due to almost total lack of fiction. Switches can be adapted to control shapes, arms and positions, or hands into almost any mechanism. It is used with push buttons, knobs, or with two safety locks, normally closed or double throw contact arrangement. Standard Model 10 amperes: 110 v. a.c.; 3 amperes, 150 v. a.c.; 2 amperes, 450 v. a.c.—January 1941.



from 2 contacts to 20 contacts. The handles are available in all standard metals.—January 1941.

Head "Air-Clamp"

A new type of hold-down for drill press work and to speed up drilling

Rust Preventive Paint

New protective paint which resists temperatures up to 500° F. and temperature range is claimed to be developed by Wilson & Williams Co., Park Ridge, Illinois. Most the new product, called Tintact, is said to come in clusters through a temperature range in tem-

THEY SEE BETTER WITH RANGER

Today's training tempo... long carriers... exposure and airways crowded... means at the controls... makes good training available a prime necessity. Ranger's unique enclosed, inverted cockpit in fine permit ample propeller clearance, yet a cockpit so closely streamlined up to the fuselage to provide a clear view forward and downward for the pilot in either cockpit.

Ranger's light weight enables both cockpits to be set well forward. Hence a student, even in the rear cockpit as shown in this aerial photograph, can see ahead and below, where he needs to see, in accompanying superior fashion.

Through thousands of hours every busy day, hundreds of Fairchild M-52 Ranger-powered Trainers (the Army's PT-29) thus waste less time pausing on the ground, spend more time profitably training in the air.



With Ranger there can be no compromise with quality.

RANGER AIRCRAFT ENGINES

Memphis, L. I., N. Y. - Div. of Fairchild Engine & Airplane Corp.



NEW EQUIPMENT

100 deg. below to 90° above axis. Steady period of rotation is on the upper and lower casting for corrections in which day or night the pilot can make his own observations as to how it then compares in the atmosphere, as it is change. Containing a unique vehicle of great explosive power, which is now being put into production. This one is able to do much damage to tanks, etc., in areas where there does not exist a definite depth indicator, increasing and completely rendering tank possible. It forms a rough, short, sharp pointed like wedge which has high impact and will penetrate most armored facets. The point is visible in this edition.—*Aeronautics*, January, 1948.



part of it is disposed on one side, so it is not necessary to "pretend" righting out, as gripping action occurs immediately so fast rate of turn begins, gripping force increases gradually, until it reaches a maximum of 1,200 lbs. then the conventional base clamp. The King-Klamp is a 360 deg. clamp installed by wrapping it around the base passing the base through the jaws and then the jaws are firmly locked with each other by hand and tightened with a wrench screw. Prepared for plane spars stressed in addition with limited space in assembly and

Birdseye Heat Lamp

Indirect-heating heat lamp has just been announced by Wilson Application Corp., Brooklyn, N.Y., which are used to make possible 180 percent increase in heating efficiency. Developed in the Bureau Research Laboratories of



Pinch Offset Box Wrenches

An extremely useful set of four short, 12 point, offset box wrenches with an clearance clearance of 9/16 in. and overall length of 10 in. to 12 in. available from the Pinch Offset Box Wrench Co., 2200 Santa Fe Ave., Los Angeles, Calif. Made for those places stressed in addition with limited space in assembly and



accessories such that component greatly improves the use of these wrenches. The short shank may be held almost entirely within the hand and securely placed in position with speed and safety. Made of the finest steel bar plated with polished heads, and available in sizes 1/2 in., 9/16 in., 5/8 in., or 3/4 in. of demand, ranging in free opening 10/16 in., 15/16 in., 11/16 in., and 13/16 in. —*Aeronautics*, January, 1948.

"King-Klamp"

A new type aircraft base clamp that eliminates the gripping forces exerted on the frame of a plane of strong has been announced by Avantair Engineers, Inc., 300 1/2 State St., San Francisco. Called the "King-Klamp," it requires strength exertions of the gripping forces of a guide and tension extremely parallel to the arm of the base pulling up the clamp from both directions against as the arm of the base is pulled down. The new principle is based on the following: Uniform bearing on the complete circumference of the base, absence of decrease of the clamp at any part around its own circumference, clamp can be used once and again as required in course of repair work as no

G. E. Thy-metrol

As an offshoot of its thyatron speed control for its motors, General Electric Co., Schenectady, N.Y., has announced a thyro-electric current regulator, called Thy-metrol, to provide simple, stepless control of direct current motors from alternating current lines. With a wider speed range is provided. With this device, the motor can be controlled with the economy and convenience

the company's new "Baldwin" type of Radiator Heat Lamp is said to control "spilled heat rays" and put them to work for heating. The bulb is designed for a ring lining of pure wire sealed inside at a point just before the glass tube begins, so that the heating element passes through the glass tube without touching it, leaving a thin space between the filament wires and the glass tube. The greater heating surface of the bulb, in contact with greater circumference of heat rays, as a given size, and, therefore, more economical operation. Available in the 250-watt, tungsten filament only, a watt fit for the 120-volt, 60-cycle service, and three-wave amplitude heating for a range of 5,000 hrs., according to the company.—*Aeronautics*, January, 1948.

Bendix Check Valves

Designed to allow a completely free flow of fluid in one direction, but to provide a positive and repeatable flow in the opposite direction, check valves for all hydraulic line rates of 1/4 to 1 in. diameter are offered by Bendix Aviation Div., Stamford, Conn. The Bendix check valves have a maximum fluid pressure that can be maintained at any position. A positive plastic poppet valve provides normally long life and eliminates the chattering which often occurs with ball valves. The check valve was selected by the use of plastic valves, which, serving as reduced as well since the valve requires



OF FIRST IMPORTANCE- Design

THREE years of Bower bearing manufacturers have proved that design is the most important element in engineering.

Likewise, the use of more millions of Bower Roller Bearings throughout engineering over a period of many years in thousands dealing large-production assemblies has proved the correctness of BOWER DESIGN.

Bearing users all agree that the exacting methods of the precision industry and the severe usage of bearings in assemblies offer a challenge that no other bearing can meet, and it possesses the highest degree of quality known to the bearing industry.

One of the results of Bower's leadership is the fact that its increased success never rests upon the ingenuity of other men. Bower engineers push relentlessly ahead—letting the world of the moment—to make new technical discoveries and to apply them always in ADVICE.

This Tapered Roller Bearing is a striking example of Bower design. It includes ten important advantages that no other bearing possesses—advantages that Bower engineers discovered and incorporated ahead of all others.

For more detailed information on Bower designs, ask us for a copy of the folder, "Secrets of Bower Roller Bearing Design and Quality."



Bower Finish Like A "Face-Lifting" Operation

BOWER DESIGN.—Bower Engineers—using a process like that of approximately 100 laboratories indicate that the "face-lift" operation of the face of a bearing from a rough, unpolished surface to a smooth, polished finish is entirely practicable. Dimensions of 16 diameters, 16 radial widths, and 16 axial widths were used during experiments, and results showed that bearing load capacity increases of approximately 15 percent can usually be attained before failure.

BOWER
ROLLER BEARING CO.
Kalamazoo, Michigan

NEW EQUIPMENT

long quick lifting and easy cleaning. Both models can be had with a sturdy square post that has a fine-fab lining for insulation against heat and cold and is a padding for the worker's comfort.—AVIATION, January, 1942.

"Stabilite" Pump

A new variable delivery, "Stabilite" pump has been developed by the Wallace-Beltene Co., Roselle, Ill. It is said that the flow is infinitely variable from 0 to 1 G.P.M. at 3000 ft. per pressure. This is accomplished by a new driving mechanism mounted on the pump which permits the pump to rotate while the pump is running to produce a corresponding stepless change in plunger stroke from zero to full flow.



no priming operation. The plunger pump will start as well under waterless lines at 250 deg. F. and do not swell through immersion in hydraulic fluids.—AVIATION, January, 1942.

Wittek Nose Clamp

Designed, built and tested at first by the Wittek Corp. of Elgin, Ill., and equipped with four spuds at the end to exert full strength at the sand head made by Wittek Mfg. Co., 480 W. 24th Place, Chicago, Ill., because stress and breaking of the hook is said to be eliminated by the unique holding feature. The clamp tightens with a 4-16 Bimatic



screw and is available in single spud or 4-spud models.—AVIATION, January, 1942.

Mobile Water Tank

Gauge Top, corrosion-resistant, and modern, has replaced his old water tank with a modern metal water tank, and is now available in compact sizes for aircraft use. The Wisconsin Paper Products Co., 435 S. Welsh Ave., Chicago, Ill., has developed a new Mobile Water Tank Unit which is light in weight and convenient. Made in two models one for the C-47 and the other for the C-46, each tank is made of aluminum and has a built-in shoulder strap, paper clip dispense and standard front. A large mouth al-



stroke. Tank overall shaft is extended to consist of joints causing for maximum either to a manual or automatic pumping system. The pump is especially suitable for hydraulic power applications where a rapid advance must be followed by a slow movement at high pressure, and for better feed where sudden changes in output affecting the water flow is required. Price is \$100 for a 25 cu. ft. water container that can be sent in four 4 ft. high cases for air transport, and weighs 300 lb.—AVIATION, January, 1942.

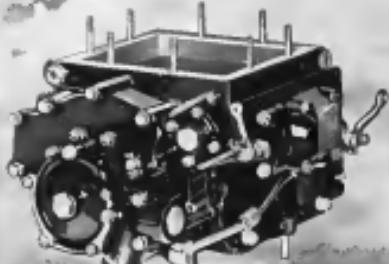


Wico Plastic Molding

Offering a new plastic molding process, Wico Plastics Co., 356 Madison Ave., E. Orange, N. J., makes thermo



NEW EQUIPMENT



THE TEN THOUSANDTH
HOLEY AVIATION
CARBURETOR IS NOW
IN SERVICE
*
HOLEY CARBURETOR CO., AVIATION DIVISION
DETROIT, MICHIGAN

HOLLEY

-AVIATION CARBURETORS-

plane sheet in a variety of compound curves and angles that range in design from heavier wings or one-piece radio cabinets to thin-walled boxes and decorative light fixtures. The material may also be formed into articles that can be produced in large or small quantities at reasonable cost. Materials which can be molded by the Walco process include acrylic, methacrylic, ethyl cellulose and vinyl compounds, as well as a wide variety of other types of specific products. The new process is believed designed to reduce the chance of warpage and other materials. Typical applications are airplane Teflon insulation, aircraft and space equipment, television, instrumentation and machine bearings, transistors, radio parts, etc.—*Airframe*, January, 1962.

Electrodes Resist Machining

To reduce machining and increase resistance to machinability, two major problems in tooling and tooling of electrodes are now being overcome by the Electrode Resistance Machining Co., 2000 E. Gates Drive, Denver, Mich. The new electrodes are fitted with insert end tape of a special alloy and to three several times the resistance to machining and porosity of conventional electrode car-



Desired Extrusion Mill

Designed by R. H. Stahl and manufactured with the Plant Engineering Department of Lockheed Aircraft Corp., a new Desired high-type extrusion milling machine has handled a full three and one-half ton production rate per hour. The machine is a development of the "Highspeed" P-28 extruder built by the General Machine Works, Chicago, Ill., the machine mills long extrusions on tapers, with cutouts in fingers and various other cuts for weight reductions, etc. The machine is 20 ft. in height with



Crane Water Pump Seal

New water pump seal having only two parts, and featuring "load-fold" sealing, is announced by Crane Packing Co., 1800 Copley Ave., Chicago, Ill. This new Delavan-type seal is said to be particularly suitable for use in other fluids and is available partially assembled, ready for instant use. Delavan is an exclusive synthetic rubber compound claimed to be superior to any soft metal sealings, such as brass, copper, silver, tin, etc. In cold water Delavan and spring is spring driven and operates as a driving coupling. Seal does not leak at all since a sliding contact with the shaft is maintained. The Delavan seals are not to interfere with pump efficiency because of their ability to flex and compress as a seal, prevent vibration transmission, run silent, leakage or vibration. Use of Delavan seals in water pumps is automatically recommended for seal cannot be modified without an entire seal or might—*Aeroplane*, January, 1962.

seals. They may be used on virtually any type of standard or special aircraft engine desired.—*Aeroplane*, January, 1962

Thompson Grinder

A tool room production surface grinder, which will maintain its initial accuracy for a long period of years with minimum care, has been recently released by the Thompson Type "F" company by The Thompson Grinder Co., Springfield, Ohio. It is of the sliding head type with horizontal spindles on the grinding wheel with no eccentric motion. The grinding wheel is fed hydraulically and hand feeds to the slide and wheel head movements. The hand feed to the slide is automatically engaged when the hydraulic power is shut off, either by the table switch or by stopping the hydraulic pump. This hand

is cutting area 22 in. wide. The carriage travels by means of track and gear, giving a feed range of from 3 to 18 in. per minute in either direction. A platen mounted on the carriage is automatically lowered into the work. Circular work is mounted on the platen. These cutting heads are used, two vertical heads of 1/2 in. x 6 in. at 30,000 rpm, mounted on slant arms which allow them to be set at any angle. The carriage is mounted on a massive cutting carriage. The machine has announced an amperage of 42 cu. in. of dust per minute—*Aeroplane*, January, 1962.

Armored Power Rheostat

To withstand exceptionally bad usage periodically where the unit is exposed to intense type power rheostat is now made by Chemtron Mfg. Co., Inc., 201 W. 125th Street, New York, N.Y. Heavy shock rheostats are said to be matched equipment in combat types of fighter



NEW EQUIPMENT

plane, usually at the expense of an accurate point lighting system. However, the Cleco 2000 is a true integrated as a performed integral language. Flat bar terminals are brought out at rear of the housing. The feed line has no end, or locking nuts which engage with the housing. The Cleco 2000 is a surface mounting the mounting of the cover and when the lock is opened. The power rheostat employs an oxidized metal wire to support the winding which is an helical type. A standard current rating of 20 amperes is available. Currents up to 100 amperes can be obtained. Resistance values of core to 800 ohms other values on special order.—Aviation, January, 1942.

Scowled Line Power Rectifier

An all purpose portable power rectifier for testing various types of aircraft and AC motors which provides a high voltage output of 1000 volts at 4 A current supply has been announced by Belpointe Lines Co., 1012 Locust St., St. Louis, Mo. The new B-L unit can be



a single switch and reverse a bulb-like light to close when it is in operation. Used as a complete load to prevent damage to the rectifier, magnetic clutch, and will operate any electron magnetizer which draws 600 W. to 900 W. in size.—Aviation, January, 1942.

New Leather Gasket Material

Edited leather gasket material, used in the external surfaces of leather to add to those of the manufactured

and available in shapes die cut to open sections. It is a flexible material, has a high percentage of recovery, and takes a minimum amount of permanent set.—Aviation, January, 1942.

Oralid Whitewire Model

Especially designed to meet industry's heaviest paint masking demands the new Oralid Model "B" Whitewire Machine, has been brought out by Oralid Products Div., General Aniline & Film Corp., Johnson City, N.Y. Said to be capable



of producing finished whitewires at speeds up to 30 ft per minute. Greatly improved features include a more efficient, streamlined pricing and developing apparatus suited for the pricing cylinder in that entire range of insulated materials can be painted with maximum efficiency, even on spool, light, narrow strips, which have great tendency to curl, enabling operator to check prints. Also Paint or varnish delivery of prints at adjustable banner shade to permit running prints of varying shade and speed, and varying painting speeds, and an efficient take-up hook-up, are included.—Aviation, January, 1942.

Rust-1-Cide "50"

Life span of finish coats on aluminum is not to be increased by use of phenolic type adhesives. Rust-1-Cide "50" according to The Rust-1-Cide Co., Cleveland, Ohio, aluminum and stainless steel, in the capacity of a bonding agent, insures that the liberating hydrogen gas will liberate of gas molecules at a much rate after paint films are applied. Test of intrinsic rust inhibiting may occur. Rust-1-Cide tests on all types of aluminum and stainless steel. Tests have shown that such adhesives tend to atomize other adhesives which are usually porous or inaccurate resilient, according to the company. By using Rust-1-Cide "50" before painting it is said that

rust within the seventh plane or on the panels and spars with equal facility. The regular aluminum paint film thickness cannot be exceeded 12 to 18 mils, or 24 w at 150 amperes. There is three option toward heavy duty trials because of the power and an expandable unit copper coil which can be used after thermal switch controlled by the plate temperature of the rectifier diode. This protection switch prevents overheat by opening a three-pole main relay which disconnects the AC input to the unit. A second option is a variable magnetic circuit breaker protects entire unit from abnormal overload. Unit is designed for 100 to 250 V, 60 cycle, 3-phase ac input.—Aviation, January, 1942.



Dural Rectifier

The Dural Rectifier, as its supplied and used, dual surface power rectifiers, is a high current rating unit. It is sold through regular surface agents. The Bausch Tool Co., Savage, Md. The rectifier will be of several current to these plates where alternating current

rectifiers, including quality coated and uncoated, and water heat shields. The rectifier has been introduced by the Industrial Division of Armstrong Cork Co., Lancaster, Pa. Known as Armstrong's No. 201, this material is recommended for sealing wires, oil, gas hoses and similar parts. The general guiding principle of protective coatings is that they must not exceed 300 deg F. and solvents acids or alkalis are not recommended. Tough and transparent it is supplied in rolls and sheets in standard widths up to 40 in and is



BIG GUNS FOR THE NAVY—Augmenting the tremendous fire-power of the United States Navy's battle fleet, squadrons of Brewster dive-bombers will give the fleet greater attacking force, wider range of action. These modern air-masters, together with hand-taking formation of Brewster Buffalo P-3 fighter-bombers, typify the air-increasing air strength of America's Navy.



BREWSTER OVER ENGLAND—An export version of the Brewster fighter-bomber, destined to assist the cause of Democracy with the fighting forces of Great Britain. Last development is dive-bomber design. Brewsters and Boulton-Pauls will soon be in quantity production at the new Brewster assembly plant in Philadelphia, Pennsylvania.



BREWSTER OVER ENGLAND—Showing the example of the British Fleet Air Arm, Brewster fighter-bombers have shown the value of the defense of bombers in the Far East. Operating from bases in Java, the new dive-bombers will augment lighter squadrons of Buffaloes now in service, will extend the radius of protection around these air ports of independence.

FRAMER AERONAUTICAL CORPORATION

Brewster

HEADQUARTERS • 1000 LOCUST ST. • JOHNSONVILLE

FIGHTERS AND DIV. BOMBER

FOR LASTING MASTERY OF THE AIR



Interceptor Command

Upon Mitchel Field, home of the First Interceptor Command, rests the responsibility for defending the Northeast quarter of the U. S.

By E. E. HALMOS, JR.

HEADQUARTERS air war command of the Army Air Force, Mitchel Field, Long Island, bears with the cost of Curtiss P-40 and Bell P-39 fighters.

More than 5,000 officers and enlisted men under Major General Herbert A. Dargue are engaged in the mounting business of preparing the air forces for their job of protecting the strategic New York City area and laying down plans for the protection of the rest of the Northeast quarter of the United States—an area roughly 200,000 miles square, containing a third of the nation's population and nearly half its industry.

Organization of the field is an exact duplicate of the organization which provides initial protection in the other three sectors into which the Air Force has divided the country.

An Mitchel Field is preparing the approximately 220 fighters of the Seventh Pursuit Wing, and the com-



AVIATION January 1942

mmander of the First Air Force Interceptor and Supply Command. The loosely organized headquarters at Langley Field, Va.

At Mitchel also has been developed and tested the first definitive plan for a civilian warning network in the continental United States to serve in case of war. From the Virginian mainland, the network employed more than 40,000 civilian volunteers in about 2000 districts, and showed conclusively that this

method of both enlisting thousands of citizens and dispatching defending aircraft is entirely feasible.

As an example of the coordination of Army and civilian warning services during the recent Atlantic seafaring test, an alert in a Massachusetts town called for all citizens at once to report an enemy bomber formation.

Three minutes later, a civilian observer in a just 12 miles away reported the same enemy formation.

Air Force officers at the filter and information center there had an estimate on the speed of the "enemy"—380 m.p.h. Although no "enemy" was announced at 13,000 or 20,000 feet.

A pursuit plane's rate-of-climb is



Officers' swimming pool at Mitchel Field. This is one of the three pools at this well equipped field. Other equipment includes clubs for officers' recreation and enlisted men's recreation, movie theater, officers' field and other facilities to help keep pilots and mechanics in top physical and mental tone.



"WING COMMAND" by John Stroemer

WAR DRESS—High flying, with oxygen gear, is a dress affair. Oxygen-fed men and supercharged engines rule the upper air . . . and

none will fly higher than the elite pilots of the Army's interceptor commands in mighty 9,000-h.p. Republic P-47 Thunderbolts. Republic Aviation Corporation, Farmingdale, Long Island, N. Y.



REPUBLIC AVIATION

BOEING B-17 "FLYING FORTRESS"



This "mighty monarch of defense", one in a series of "Flying Fortresses" being supplied by Boeing Aircraft Company (Seattle, Wash.) both to the U.S.A. and to Great Britain, rated to be one of the world's latest long range bombers now in production. Like the others in this series, three guns of the air are equipped with NORMA-HOFFMANN PRECISION BEARINGS in the vital control applications, providing rigidity together with extreme sensitiveness and instant response.

Whether their product be designed for military,

Write for the Catalog. Let our engineers work with you.

NORMA-HOFFMANN BEARINGS CORP., STAMFORD, CONN., U.S.A. - FOUNDED 1911

PRECISION BALL, ROLLER AND THRUST BEARINGS

roughly 1500 feet per minute, so speed is in the neighborhood of 400 mph. This 52 minutes were required for defenders to reach sufficient altitude to attack the "fortress".

A pursuit squadron 50 miles south of the second observer 20 min. was sighted, and saw the bombers a few miles north of its position. Dropped from, from first report to plane, about 1000 feet above ground.

It takes about 18 days on the ground to use up the air, under warlike conditions to keep 40000 planes aloft. Of the total number of planes, only 2000 are available at the field, due to damage, etc. The remainder represent reserves essential to maintenance of the post as the Quartermaster Corps, Signal Corps, medical detachments, and the like.

The average machine is 22 planes of 4



Northrop P-61 Black Widow in constant service to protect marshes and bogs from enemy bombing and invasion.

In a high school education and comes from a small town. He's had seven years of training under Army sponsorship in a private institution, usually located in the field, due to the fact that since his first three weeks—when he underwent training as primary driver—he has been closer to that of a factory worker than of a soldier. Excepting his ground duty, he works a seven and a half hour day—gets at least one full day off per week, and may get a maximum of 30 days' leave per year. His salary averages \$30 per month, but he is supplied with his clothing, lodgings, food, and incidentals—most of his revenue goes to his parents.

The Average pilot at 22 years of age, uses a small town boy, and a college graduate. Normally, he has had little or no experience in the air, even as a passenger before enlisting as a pilot. After completing his primary and

basic training at Randolph or Kelly Field, Texas, he is assigned to Mitchel for regular duty. Although a trained pilot has training continuous endlessly at Mitchel, in classroom work, formation flying, tactics.

He gets at about 30 hours of flying a month, also works a seven and a half hour day. His pay may go as high as \$325 per month (as a second Lieutenant), but out of it he must pay for his own food and lodging, and buy his own uniforms.

Stand for New York's best reform minor, John Purdy Mitchell, an Air Corps Major, the pride the sons of the field, and the pride of other Air Force men at older stations.

The re-enlistment includes, in addition to herculean hardware Administration building, and 11 concrete and steel hangars; more than 400 buildings, inc-

(From *The Army* (2))



Duty members diggin' are a daily concern. Below, pilots ready to take off on the runways of their bases.



Rebirth of The R.A.F.

British air strength has multiplied many fold since the war began and the work of each of the several Commands has been greatly intensified.

The article was written in England. In accordance with official British policy, no signature is included.

I

THE hard figures published for all the world to read, the Annual Air Estimates for the year ending in March 1945 (in March 1946) show Britain's air strength following a remarkable rise during the war. Generally, at first, the Royal Air Force's total—of aircraft, ground and headquarters troops, and of administrative and transport units—was steadily on the decline. From the very start of the Nazi invasion, the R.A.F. was built up to something like an former position place among the very powers of the world. From a 2930 aircraft force at the outbreak, and 21,000 regular personnel and about half as many auxiliaries and reservists, the figures rose in 5 months to a projected final low of 10,000 aircraft, 22,000 regular personnel, and additional units such as Home and Overseas. With these totals, the targets for March, 1940, were to go 150,000 regular officers and airmen and over 100,000 auxiliary and re-

Wartime Development of the R.A.F.

Actually the figures for the year which ended on March 1940, were determined to become merely "paper figures." From the autumn of 1939 the fog of war descended so rapidly that details of war descended as rapidly as the planes themselves. One of the two mounted monoplane types with which Britain entered the war—

the Gloster Gladiator—had already been removed. This makes rather more than a quarter of a million less and partly trained airmen of all sorts—within five years of the date when the entire strength of Britain's air forces was but 10,000.

The financial provisions for those pre-war years of Britain's air accelerating are equally impressive. For 1936-1938 Britain invested £37,000,000 for the whole of its air services—a figure to which it was known the Germans were secretly spending in preparation for the second "Dunkirk." That 17 million—not much more than the current cost of a single day's expenditure on the war—included subsidies for civil aviation, as well as the cost of armament research, development, production, works and so on. For 1946—the year of Marshal's financial provision for Britain's air defense and civil air development had been multiplied nearly eight times! For 1948, it was scheduled to be £200,000,000—nearly 24 times what had been set aside for all Britain's air services in 1936. Such is the bare pattern of Britain's air development as far as the figures run up to the time when the Nazis began to create the "Dunkirk" in 1940 as a prelude to world war.

Actual figures for the year which ended on March 1940, were determined to become merely "paper figures." From the autumn of 1939 the fog of war descended as rapidly as the planes themselves. One of the two mounted monoplane types with which Britain entered the war—

the Gloster Gladiator—and, last a top speed of around 225 mph. With its new 2-seat, supercharged engine the Mark II Gladiator has a higher ceiling, a better rate of climb and a higher top speed. And with that increased performance it can carry the terrific armament of 12 machine guns in alternatively four 30 mm cannons.

Operations and Command

The organization of the R.A.F. has been continually changed during the war. A complete reorganization of the Metropolitan Air Forces was effected early in 1940, when 16 which functional commands were substituted for groupable commands and operational groups within the commands were given a new significance.

The various main functions of the air force—fighting, bombing, coastal work and training—were allotted to a separate command, each under Air Officer Commanding-in-Chief. About the geographical basis still remains. There is a Middle East Command, Iraq Command, and so on. These regions, however, carried out no peacetime but decentralized for combat service needs, has stood the test of combat conditions. Some new commands have been added—namely the Army Co-operatives



and the Balkan Command—and the original Training Command has been split into two—one for flying training, one for technical training. Coastal Command has been recently expanded. But the functional groups of the R.A.F. generally still survive, and that the functional pattern does not mean that the jobs of the different Commands are, as is often said, dead. Certainly the operational Commands do not lead a hand with one another. Coastal Command is not about doing a job of bombing. Bomber Command ought to help with Coastal rescue missions. But there are certain basic difficulties.

Fighter Command controls all the principal air defences of the country, apart from patrols over seas either directly or for purposes of re-enforcement. Fighter or so-called interceptor aircraft, anti-aircraft gun batteries, searchlights, anti-air raid and radar stations dominate command and the targets balloons are all allotted to a single command, each under Air Officer Commanding-in-Chief. About the geographical basis still remains. There is a Middle East Command, Iraq Command, and so on. These regions, however, carried out no peacetime but decentralized for combat service needs, has stood the test of combat conditions. Some new commands have been added—namely the Army Co-operatives

and the scope of Fighter Command. On Bomber Command, Major Air Officer Commanding-in-Chief, probably the second largest of the R.A.F. commands, controls almost all the offensive aspects of Britain's air defence against the enemy. Heavy bomber aircraft, serving from specially modified airports like Elvington in Lincolnshire, go as far as Sterling and Flying Fortress are night and day, leaving Britain's air spaces to enemy targets, ranging from Italy to the coast of Norway and far into the German hinterland.

Cosy Command is almost as air space as it holds. The duties are as wide as the text and covers a jumble. Operating a submarine, "dousing up" a flat-top target, an enemy cruiser, launching a gun salvo—its all due to the pilots and crews commanded by Air Officer Marshal Sir Philip Joubert.

The other partly R.A.F. Commands are concerned in running the Army Co-operation Command—air armless co-operation. These jobs are run by the personnel and units the staff who carry out the active operations. Here are three names and their Air Officers Commanding-in-Chief:

Flying Training Command—Air Marshal W.L. Webb.
[Turn to page 239]

Above: Gloster Gladiators, the first British fighters to be used in air battles of the war, are seen in full array at the plane. These planes are starting in their stage in the history of Britain.



Prelude To War

THE most intense air exercises ever held in this country were completed last month in the Carolina sun before the outbreak of the present war. Primary objective of the maneuvers was to achieve a coordination between air and ground organizations. All other objectives were secondary. According to Lt. Gen. Leslie McNair, Chief



Field office of the First Pursuit Group, near Spartanburg, S.C., with a jeep ready to take the Commanding Officer for a quick trip to his field.



Tell Aeromotors hangar in Gao, Demia. First Army aircraft were replaced by the 10th Army aircraft here because of Spartan hangar space.



of Staff of GHQ, a great deal was accomplished in the exercises in that the units of command and the coordination between the various air and ground units were more effective than in any other war games.

The First Army, commanded by Lt. Gen. Hugh Drum, comprised some 162,000 men, including the First

Air Support Command. It was opposed by the Fourth Corps, with Major General George Grossowd commanding, and consisting of 95,000 men, including the 20th Wing which Col. Jim Estes commanded.

Exercises were planned especially over some 80,000 square miles of terrain. The First Army and the Fourth Corps were all extremely mobile. Chief concern between these groups and those arrived so earlier this year was that miles of warfare were followed as far as possible. This was especially true of the air forces. Airplanes were dispersed to small, sheltered fields, instead of being lined up on large, open fields as shown in photographs of the Lewisburg games in the December issue of *Aero-News*. Cut-and-dried, revolutionary and other lessons learned from the war were utilized.

It is unfortunate as well that the Carolina maneuvers provided extensive and valuable training for all branches of the service.



Capt. Eugene Ley Jr. of Six Corps Tac Recon, being cut out of a Bell P-59.

A Republic P-47 static display (left). At right is Lieut. F. G. Griswold, C. G. of Tac Pursuit Squadron, based at Gadsden Field.

A Republic P-47 static display (right) from the results of a surprise incendiary demonstration made during the exercises.



Looking at an A-30 Douglas attack bomber from 1941 aircraft. The aircraft was in these maneuvers used as fuel tanks were made to hold ships on the ground.

A Lockheed P-38 of Col. Jim Estes, 20th Wing, is shown in a permanent display by a crew member attached to this unit. Bright at the north wall gives an idea of the amount of work in building the permanent.



Making It Easier and Safer

FOR CREWS OF FIGHTING PLANES

Klixon Circuit Breakers



MASTER-TYPE CIRCUIT BREAKER
Designed for ordinary switch use. Weighs only 1/2 ounce.
Dimensions 1 1/2" wide by 1 1/2" high.



PUMP-TYPE CIRCUIT BREAKER
Used in fighter planes like the SNCASO Chasseur and
Rafale. Klixon pump-type breaker is known as
the "Silent Breaker" up to 1000 watts.



**SWITCH-TYPE CIRCUIT BREAKER—
TYPE G-434A**

Small compact and light, this breaker is manufactured
with both contacts of unequal dimensions with the result that
it can be closed with a single tap and opened with a snap of a
finger. Weight only 1/2 oz. Dimensions 1 1/2" wide by 1 1/2" high.



**SWITCH-TYPE CIRCUIT BREAKER—
TYPE G-434B**

In light for switch. Dimensions the width of the G-434A
but with unequal contacts. Weight only 1/2 oz. Dimensions 1 1/2" wide by
1 1/2" high. This breaker is used in aircraft, bombers, transports, etc.

KLIXON

Spencer Thermostat Co., 22 River St., Andover, Mass.

MANUFACTURERS OF THERMOSTATS AND TEMPERATURE CONTROLS FOR AIRCRAFT CARBON, RAPIDS, GEHRIGS AND INSTRUMENTS

More in military planes have enough to do their duty. That is one of the reasons more and more Klixon Circuit Breakers are being built into fighting planes of both branches of the service. Even though these breakers are not affected by heat, temperature extremes, they still prevent damage from thermal overloads. Moreover, if an overload causes the breaker to open the circuit, the current can be re-established if overload conditions are removed without ever having to touch a switch. No replacement of fuse parts are necessary. These breakers are permanent protective devices—good for continuous repairing service.

Small, compact, rugged, and vibration proof these breakers are easily adapted to panel mounting. There are millions now in service in planes, tanks, trucks and homes. Send for complete information.



Gloster P.M. (11.3)

The British call it "The Gladiator"
or "The Klixon."

A Case in Point

FOR your information, the Tomahawk
is an American-built plane with an
Allison engine.

And of Allison engines than a bookful
of dreams or stories.

The plane fact — they last and it takes

And with due allowance for the fact that
the Americans are great air fighters —
it is still significant that only one of these
planes was lost for every six that

That will give more about the speed, the
maneuverability, the all round prowess

In view of that, you'll find further interest
in the fact that these power packed
Allison engines are rolling out in volume
— hundreds upon hundreds each month.

More than that — as we've learned to
make them so volatile, we've also learned to make
them tame. Twice in the
past year they've been
rappaged up in horsepower,



Allison V-1710
The first mill in "The Tomahawk".

Allison V-1710-A
The second mill in "The Tomahawk".



TOMAHAWK SQUADRON
IN MID-EAST CLAIMS
18-1 VICTORY RATIO

with a saving in weight to horsepower
ratio — and no increase in size.

More than one million square feet of
factory space is now busy with Allison
production. More than 4000 men of
speed skill and training are now em-
ployed.

And many words add to the evidence
that America has in the Allison the
finest aircraft engine in the world.

Allison CM
DIVISION OF



Lighting At The Washington National Airport

By W. C. NORVELL, Aviation Lighting Engineer, Westinghouse Electric & Manufacturing Co.



A. At left, Groundskeeper for runway illumination with doors open to show reflector system.

B. Illuminated view of light #3 at dusk showing a bright green and yellow the lantern part when it is lit.



HEARLY a year of patient, intensive testing of the Washington National Airport and its complex lighting and control systems has fully justified the superb planning of all the engineers and officials of the CAA and private companies who participated in its design and construction.

The lighting and signaling systems still stand as the most massive and elaborate ever employed on any airport. The accompanying chart at a glance the plan of the airport runways and buildings and details of the lighting installation.

At night and in thick weather these lights tell the pilot his bearing, where the airport is located, 2. Where the boundaries begin and where they end, 3. Which runways to be used for landing.

4. Whether or not the field is clear for landing.

5. What nearby obstructions or traffic hazards on the field are located.

The first suggestion of "control" comes from about 90 miles away and is the sun's location. Nightly, the plane is guided toward an airport by a series of double red running lights, showing red, white, and green flashes, permitting an oscillating bearing. However, since Boeing Field just across the Potomac has such a beacon, its duplication at Gravelly Point is unnecessary. From a distance of 3 miles out the Washington National Airport auxiliary beacon can be seen. This beacon flashes the letters "WNA" in Morse code to assure a smooth and trouble-free approach, though it is also visible from the various other fields nearby.

As the ship approaches within 8 miles of the field, what looks like the road indicator and a spray of white, yellow,

red, and green lights are visible. Boundary, range, and obstruction lights are clearly discernible. They are set on all right so that the airport will be identified and its location will be evident to any approaching pilot capable of reading her arrival by radio. All are of the standard CAA type.

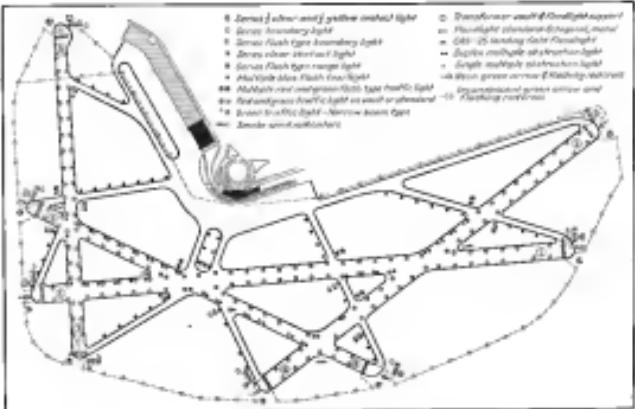
Boundary, range, and obstruction lights use clear, green, and red pressure globes, respectively. Two separate boundary circuits are used, each being fed by a 75-watt constant-current regulator, which applies 5.6 amperes to the lamps in series on the circuit. An incandescent lamp is on the same circuit. The auxiliary lighting at least one boundary circuit in operation to make the other interrupted by current failure.

Green flash-type range lights are used at each end of all runways. These are ended so that the north-south has five at each end and the other runways have 2, 3, or 4 at each end. This enables the pilot approaching the field to pick out, for example, the two groups of five range lights and lead on a line between



These traffic lights for the control of take-offs are located on the northeast boundary road at the runway end. One boundary light is lit at the tail of the road.

AVIATION January 1940



Lighting plan of the Washington National airport.

them and would permit him to find the runway ends if no other lights are on. A group of range lights (like those at each runway end) is lit at one runway

and from the "other" boundary circuit, is lit, progressing around the field, at the next runway and by the "other" circuit, and so on around the perimeter.



These traffic lights near both ends of each runway at the Washington airport, are so positioned they light the entire length of the runways with their 300-watt lamps without obscuring their illumination in a box-like area.

scattering from one boundary circuit to the other. With an even number of runways, this results in the range light groups at the opposite end of the same runway and runways at least one of the four outward-bound runways have their range lights use the bank type, rather than the conventional or e type. These may be used at fields where center lights are located, cause the center lights cutoff the running edges and it is more necessary to "bank" at a slight tangent such as a green range light covered on a curve.

Unfortunately, many airports are surrounded by relatively low buildings due to either the nature of the terrain and natural features. Relatively low obstructions are usually here, thereby forcing reduced obstructions into a less diversified and there are sometimes few buildings or even none which project above the top of the globe. Buildings are marked by an obstruction light on each corner and on the peak of the roof. These are supplied from the boundary circuits but are controlled directly by the boundary lights to turn them off when the building project is obscured.

The Terminal Building has two obstruction lights marking the uppermost and west wing assembly which is

(Turn to page 19)

SCHATZ
Precision
AIRCRAFT
BALL BEARINGS

SCHATZ PROVIDES THE AIRCRAFT INDUSTRY WITH THE FINEST CONTROL BEARINGS HUMAN SKILL CAN DEVISE • THIS PREFERENCE FOR SCHATZ IS THE RESULT OF PROVEN PERFORMANCE PLUS A REPUTATION FOR QUALITY UNPARSED BY ANY OTHER CONTROL BEARING •

The SCHATZ MANUFACTURING CO.
POUGHKEEPSIE, N.Y.

Desert Office: 26440 Beck Street • Chicago Office: 1913 N. Wabash Ave.
Desmond Office: 422 Standard Building • Los Angeles Office: 2410 Wilshire Blvd.

Making the Terminal Airport Pay

How LaGuardia Field has ended its second year with a commendable financial record.

AIRPORTS as unusual as to be almost without precedent in American aviation was announced in December, in LaGuardia Field, New York. Municipal Airport, dedicated its second year.

The airport had ended its second year of operation with a profit over and above payments toward amortization of bonded indebtedness and operating expenses.

In a financial report to Mayor F. H. LaGuardia, Dock Commissioner John McKeon said that the revenue obtained from the airport operations during 1940 was \$629,684. One of the factors contributing to the success was the collection of \$13,804,091 of bonded debt and \$46,258 for personnel and operating expenses. Net loss was \$12,685.

The report was the first released to the public since the public began operations on Dec. 2, 1938. It said total cost of the airport was \$43,986,091 of which \$119,893,391 was supplied by the City of New York and \$21,937,000 by the Federal government.

In the first two years from all sources, with \$119,893,391 to make a total two-year "total" of \$1,203,180,08.

On the basis of the past two years,

it was estimated that receipts for 1941 will exceed \$260,000.

"There seems to be no doubt," McKeon said, "that we will pay off the entire bonded indebtedness well within the prescribed 40-year period." He pointed out that the city, state, officers of the Dock Department and the board applying every strength at an airport, other than discovered that except anything on the field could be made to produce revenue.

Orchard's expected revenue products, of course, included fees for rentals of hangar and office space to aircraft, charges for scheduled landings of transports, and rentals of space to restaurants, and other services for passengers and public.

Hanger-rental, which produced \$19,182 in the month of October, 1940, alone, are computed at rates varying from 12 to 40 cents per square foot, depending on whether the hanger was built, jointly by W.P.A. and the City or by the City alone. Scheduled landing fees are charged at the rate of \$25 per schedule per month. Rates for



Photo by Alfred Palmer

hangar planes vary from \$5 to \$50 depending on the height of the door, and rates per space in the administration building are from \$2 to \$5 per square foot.

But other sources were quickly found.

The observation deck, provided for visitors, was made a paying proposition early in 1940. The one-cent charge produced \$116,256 in 1940 and \$102,382 in 1941. Two parking lots, where visitors are charged 25 cents per car, produced \$89,865 in 1940 and \$31,200 in 1941.

The field was never undertaken "La Guardia Field"—a name which hasn't stuck—so it does in truth make charges for needed services. To visitors, however, the city has an irresistible appeal.

It pays. For example, a limitation of receipts is \$36,000 for October, 1940, outside the following areas:

Wharfage (for all trailers bringing in cargo) (not public rates).
Car boxes (not public rates).
Telephones (percentage from each box).
\$400

For a 10 cent charge, made for cars standing in food lines for dinner, \$100.00. — \$62 Engineering Dept. (Highway Dept.) — \$100.00

As originally designed, the Airports authority had planned airport terminal floors for hangar owners to receive rates, ticket counters and offices, a bar and two restaurants and weather bureau, C.G.S., and other offices.

Now undergoing its third remodeling since opening, the building still contains a complete post office, but it lacks both of the others. The Trans Company, a bus system in New Jersey, now owns and runs a cafeteria, a private club, in addition to the dining room it now operates.

Box office, which once had been utilized for show space, each occupied by displays of large signs and such, producing \$600 per year in revenue.

In 1942, enough space in the Administration building are expected to produce \$20,000, exclusive of the \$40,000 annual rental of the Hotel New Yorker, for the bar and restaurant.



CIVILIAN FLYING

Ready For Defense

Airport clubs can be "ready" rooms for Civil Air Patrols

By WILLIAM D. STROISMEIER

Adm't and Public Relations Mgr., Piper Aircraft Corp.

JEET A little over a year ago in these pages the author did a story on aviation country clubs (AVIATION, November, 1940, p. 30). Since that time, what was once a sport and a hobby for those who but undergo considerable change. Moreover, the basic ingredients of an extricable position—new airports, hundreds of small air fields and thousands of light planes—have become almost overnight, at long predicted by private flying's leaders, a valuable addition to the national defense.

The Civil Air Patrol has been established in the Office of Civilian Defense and is being organized extremely at a rapid pace. Director LaGuardia appointed Maj. Gen. John P. Conroy, Air Corps, Artillery, Commander of the C.A.P. Vicksburg, Miss., region, and several other districts are offering their time, their planes and their greatest abilities to defense and have spontaneously relented all thoughts of amateur pleasure to the air for the duration.

The airports, small hangars, club buildings and other structures will now serve as operations bases and "ready" rooms for local patrols which will patrol very heavily, recruit members and increase state and private training for medical supplies, personnel and materials in emergencies.

Following publication of the original story, many communities became interested in the development of aviation club houses. This interest was manifested both by aviation clubs and flying school operators alike, who realized thoroughly that the days were over when embassies were intended to sit on an empire you had to win their seats in. And the more and more residents of America had had considerable correspondence with these groups throughout the country on the matter. This correspondence

showed there was a definite interest in improving local flying along these lines which were similar in many respects to the "air park" idea suggested in *Aviation Secretary of Commerce Robert H. Bleckler*—a recreational center which would attract pilots from neighboring cities, and which would afford local citizens a place both to fly and to enjoy the sport in the same atmosphere.

Obviously, most developments along these lines necessarily has been postponed because of the emergency. Building clubs have risen and new buildings of this nature are practically ruled out by OPM. But it has been interesting to note that as a direct result of the



Scarsdale Flying Club built this log cabin at the beautiful airport. Gates is 30 by 40 ft and was hand made. Picture below shows the hangar interior. Chimney and fireplaces were built by members. This building cost the members about \$2,000.



Present at the dedication of the South Dayton Airport Club house (left) are CAA Director Donald H. Crossley, Administrator of CAA western section inspects the testing take-off with Jerry Chatterton (left), and Tracy Service, general manager of the City Service.



South Dayton Airport club house (right) is a picture from a recent issue. The modern club house is shown. Tracy Service, director inspects the office. Below, to the left, is a boy and on the right is the lounge.

thoughts expressed in AVIATION, last year, at least one club house has been completed following almost exactly the thoughts and suggestions contained in that paper. Exactly a year after the thought was published in this magazine, the club house at Dayton's new South Dayton Airport was dedicated, and should serve as a most interesting example to other aviation operators who have these future interests in mind. The emergency is over and private flying has the courage and ardor which are predicted of it.

Not only the club house at South Dayton alone, but the entire environment and circumstances surrounding this airport are interesting. They point to some thoughts which will enter the minds of every body aside airport operator in the country who in some way happens to remember that the Jenny days are over for good. Dayton still, though, is the field that is the cradle of private aviation, is more or less a typical tiny town. A population of 211,456, it has a fine municipal airport with commercial operation, another commercial airport East Dayton, and now South Dayton airport. Of course, there are also Wright and Paterson Fields, but these are both military airports and do not count as far as commercial flying is concerned.

The South Dayton country club owner was conceived by one of Dayton's younger business men, H. Gerald Chatterton, a typical automobile dealer who has handled Buick sales for the past twelve years at that city. Increasingly, he is one of many persons who bought a Cub and then learned to fly a solo at his local field. This was in 1938 and at that time Jerry Chatterton's main interests were with his own business, which was airplane parts handling, and with his wife, who was helping him to enjoy flying as well as helping his desire to enjoy flying. From his car Cub with which he started, Chatterton

has developed an extensive aviation business and has taken over the operation of East Dayton's airport, where his son Charles now conducts C.P.T.C. contests, and regular private flying business. The one large hangar which houses a number of private planes which have been sold through Jerry's aviation company, Air City Flying Service.

Partly, if Chatterton was the type of airport operator who applies only personal taste in running his business, it would be difficult to conceive of anything more pleasant and attractive. Just north of the field is the private estate and airport of Col. Charles Davis, whose private mansion on top of a small hill overlooks both airports. Directly east of the field, but not presenting any obstacle at all, is another big hill, on which several very attractive estates are located. Just beyond the hill is the site of Dayton's most exclusive country club. Chatterton himself lives on a small plot at the northeast corner of the field.

Most significant in the order of developments of South Dayton's airport is the fact that the first building to be erected by Chatterton was the club house. The author has long maintained that one of the main requisites necessary for a successful air field is just such a building, which, while it need not be elaborate, must be comfortable and attractive, so that it can serve as an important air flying equipment itself. At Dayton, no number of elaborate hangars could have, stimulated as much interest and enthusiasm as the club house which was dedicated last in November. With the club house completed, hangars are now going up.

As already mentioned, the club house follows almost exactly the design suggested in AVIATION, January, 1940. Chatterton appears to be the builder of the building is most attractive and from the road outside is extremely favorable impression. The overall dimensions of the building are fifty-four

(Continued on page 282)

SIDE SLIPS



Cesna is in Uniform

For many months Cessna has been doing a big job for national defense. Its famous twin-engined "Cessna Crane" has played an important part in the bomber pilot training program of the Royal Canadian Air Force and orders for similar Cessnas for use by the United States Army Air Corps are being filled ahead of schedule.

It's our fight now—and the challenge is accepted . . . We of Cessna pledge continued all-out effort toward the task that lies ahead, that the American way of life may not perish from the earth.

Yes, Cesame is in uniform!

CESSNA
Aircraft Company



CONTENTS FOR THE 44-5 (1998) ISSUE OF THE JOURNAL OF POLITICAL SCIENCE

卷之三十一 附錄

• **THE RIVER MUSKOKE** flowing and meandering around the lakes—on none of this country we have been more and more impressed with the fact that almost every outlet, even the village streams, still under his spreading abounding trees, is doing some sort of work for the regional drainage. This of course involves high banks over ledges, very capable gullies, and flood banks by far greater proportions. This natural dammed rock has run reached such proportions that it has a tendency to make a bridge.



will release from their posts for this very essential work' roles not police guards, fuses, etc., around only the portions of the country which are not working on defense orders.¹ The guards thus released would be placed on other duties, —and think of the savings in force maintenance and electric lighting!

We feel sure this scheme will work, as conditions aren't greatly different from the days of the mine when the range owners had it as the responsibility of the homesteaders and the miners to erect fences to keep cattle off all their properties.

33 To introduce visitors, name inside next come from essential bars. Including a fresh note into this temperature page we give you the first and only knowledge originating in research. One of the girls in our office goes there and she gets it from her mother who got it from another woman who got it

Rudolf Hess went to Hitler and told him he didn't think Germany could win, and that peace should be made with England at once. This made Hitler mad, and he said to Hess, "You go home and I'll come and get you." Well, Hess probably left just as you would.

So Hess called up Paul Zimmerman and said tell him what a fat he was as Zimmerman's last Hess one of his former players to the in Scotland and then Zimmerman disappeared and hasn't been seen since. That is right off the pulpit. PS: Hess was right Hitler did come to get him—with no armed guard.

Winnipeg as neither is better or
worse than a standard car, it's just a
new question, but this transport pro-
ject has been proposed
as such at several other locations.
The other is Captain Eddie Ralston's
proposal of a rail link. As I am not
entitled to an opinion right at the other side's feet
in the cockpit, nor was I invited
to the crack that our transport had
torn up and that service ended
earlier and all bookings were canceled
so quickly. Ralston's proposal
will pass my testifiers over the letter.

We aren't taking sides. The glass is a pretty girl in a green coat. One of the other girls is a blonde, a little bit more serious, perhaps a trifle more stern, perhaps a trifle more serious, as a friend. We don't know the answer, but if we pull one more string and send passengers to separate planes and let them decide, those won't be lying come argument.



Measuring Incentive and Justice Bias for the New

THOUSANDS OF TESTS TO GET THE RECESS RIGHT



Speed product deliveries
by saving assembly time...

Specify Phillips and Save 50%
PHILLIPS RECESSED
HEAD SCREWS

D. B. Phillips and Sons and Phillips Manufacturing Company have joined forces to form Phillips Manufacturing Corporation.

REED SCREWS • RECESSED SCREWS • SPECIAL HEAD SCREWS • SPECIAL THREAD CUTTING SCREWS • SCREWS WITH LEAD INHIBITORS

19 SOURCES OF SUPPLY

Phillips Manufacturing Corp.,
100 Main Street, New Haven, Conn.
D. B. Phillips and Sons, Inc.,
Quincy, Mass., Boston, N. H.,
Montgomery Ward Co., New York, Atlanta,
Philadelphia, St. Louis, San Francisco,
Chicago, Milwaukee, Cincinnati, Toledo,
Cleveland, Pittsburgh, Newark, New Jersey,
Newark, New Jersey, Newark, New Jersey,
Pittsburgh, New York, New York,
Philadelphia, New York, Philadelphia,
Cincinnati, Ohio, Toledo, Ohio, Cleveland,
Milwaukee, Wisconsin, Chicago, Illinois,
Newark, New Jersey, Newark, New Jersey,
Milwaukee, Wisconsin, Chicago, Illinois,
Milwaukee, Wisconsin, Chicago, Illinois.

AVIATION January 1941

War Forces New Plans

By SELIG ALTSCHUL

THIS war provided by Japan will take its toll upon the United States such as it has never seen before. The process may be a brutal one. The toll will be for enormous quantities of all types of armaments.

The aircraft industry promises to be on the forefront in the defense and also faces stimulation of production that is bound to be heavy.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the ever-increasing importance of the industry.

The air carrier shares were particularly weak. It is considered unlikely, by many observers, that the air carriers would be permitted to dilute in the 25% limit that is allotted to the industry. The air carriers would be suffering in this more if they were the only ones. The essential air carrier pilots to active military duty were made an amateur. Standard two will be the first in the public mind as to possible difficulties imposed upon regular air line operations.

On the other hand, operations being in the very theater of war, the American aircraft companies are now concerned only in war work. In due time, however, it will be emphasized that the Pacific coast represents a well-known relative to the company's far-flung operations.

The needs of manufacturers have found the Phillips Recessed Head Screw a means of reducing assembly time as average 50%. Phillips Screws are used in the majority of units turned out by aircraft and associated industry.

With it is possible due to the air transport industry, who came in for some criticism, it is difficult to envision any serious obstacle placed in the path of the industry. The aircraft industry will be the most important development for all those industries that suffer and even disappear in the process. The aircraft "workers" will have little incentive with greater disposal of all of the available raw materials and supplies. The full war effort will bring in its wake an additional revolution which will completely dwarf the unusually staggering defense effort of the past year and a half.

The war and its successful prosecution will undoubtedly postpone a number of major financing operations. Prior to the present headlines, these unusual events were of no small import to the aircraft industry.

New equity financing proposed by

United Aircraft Corp. created considerable surprise. This is not illustrated by the market decline of 6 points or about 15 percent from \$10—the price paid obtaining prior to the option of the stock below calling reduction became evident.

You has surprising as the purpose of this new financing. The war expansion of aircraft production facilities in recent years has been financed, in no small measure, by the United States Government. To a large extent, largely through contracts assumed the cost of the actual expansion.

The aircraft industry promises to be on the forefront in the defense and also faces stimulation of production that is bound to be heavy.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

The aircraft industry, much more fully during the war, showed considerable apprehension as to the events ahead and was no exception to any individual group. All aircraft stocks participated in the rally despite the obvious implications of the industry.

(This is page 20)

THE AVIATION

NEWS

BLAINE STURHORN
Washington

C. P. Mallenfeld
Pacific Coast

Ronald Hawkins
New York

S. R. Leslie
New York

January 1943

Jouett Calls Aviation's Achievement "Industrial Miracle"

Col. John H. Jouett said the aviation industry performed "an industrial miracle" in producing nearly 20,000 warplanes during 1942.

The President of the American Chamber of Commerce of America declared that American aircraft will unquestionably prove to be the decisive factor in their war.

At the annual meeting held in New York December 1, Jouett told the members they will be called upon to produce nearly 180,000 warplanes during the next two years.

Speaking on an industry which a few years ago produced an annual value slightly less than the leather goods business and ranked 10th below the auto, Jouett, coupled with Jouett's attack and declaration of war against the Axis powers, called for the full impact of the task still facing the industry.

Jouett pointed out that during last year plant space was increased from 20 million to nearly 40 million square feet, not counting that now under

construction which will be in operation within the next six months.

Resounding upon outbreak of war, the administration decided the half-yearly production quota of 10,000 per month. This, along with heavy overseas demands for all types will call the construction of millions of square feet of new space.

Jouett reported the monthly aircraft production rate is now about 6,000,000 horsepower. This will increase to 20,000,000 by mid-1944, or 10 times the pre-war total, he declared.

The propeller production rate has already passed 500,000 a year.

The present backlog of the aircraft manufacturing industry is well over \$100,000,000,000 and the industry will surpass the automotive industry in volume of business very soon.

In view of the very

near future

and the figure will be more than doubled if present plans carry through, the industry must



Production of planes for U.S. Army has moved into high gear in the mammoth \$140,000,000 plant dedicated by Curtis Wright at Fort Schuyler, Columbus, Ohio. Photo courtesy shown here is a Curtiss Seagull.

the creation of the industry's leadership and the rock and roll she was easier to beat at than the independent Indians on Waco Island. The story is told that when commissioners finally

were established after the initial assembly in the Prairie City Commandery at Fort Riley and if there was anything they wanted, "Yes," came the reply, "hand us some more Japs." In effect, our U.S. aircraft industry has said, "Bring on your

AMERICA UNITED

Aeronautics Standard achieved in 1942 the greatest propeller output in history. In thousands of airplanes - Americans all - face the challenge of the new year with the same conviction that no power on earth can halt a united America.

HAMILTON STANDARD PROPELLERS
An American manufacturer
ONE OF THE THREE SOURCES OF ENEMY AIRCRAFT PROPULSION



(Associated Press)
AMERICAN B-17 planes in the Oriskany, N.Y., base of the Bureau of Aeronautics stand guard while B-17s "Biffles" (B-17Gs) are being assembled before joining R.A.F. Squadrons assigned to Britain.



(Associated Press)
RANIER REEFER aircraft carrier (U.S. Navy) during recent communications exercises at NEPTUNE Naval Operating Base.

AVIATION DEFENSE

AAF Emphasizes Radio to Corralize Bombers

"Bom" Army air experts during the Coriolis maneuvers, comprised some 300 personnel, light bombardment, observation and flying boats, and included such units as the First Air Support Command, covering all 56 air groups assigned to the First Army. Commanding, Lt. Gen. Mark A. Gandy, Lt. Gen. John P. Greene, who was responsible for these assignments, directed attacks on tanks or armored columns at designated times and places; the bombers were asked to position themselves, swoop in, drop their bombs and disappear.

The air unit is a component of the First Air Force with the mission of utilizing with greatest force the newest maneuver weapons in 3,000 hours flying time per day.

"Many people do not realize that enemy planes, besides being a constant harassment with the ground," said Lt. Col. Palmer S. Bowley, Signal Corps. "Actually they may be more important than tanks. Flying in circles, aviation becomes in this day of fast-moving mechanized forces when advance is a few minutes. But the advantage lies in us still getting his orders, because we're flying."

Groups of group and squadrons headquarters, scores of airplanes at the site, were seen taking off and landing in continuous flights during the maneuvers. Two made the first field test under conditions approaching those of actual war.

During the maneuvers also came for considerable practice and emphasis will be laid as this in connection with experiments in the light planes which comprise the new liaison "gunsmopper" squadrons.

Admiral John Towers Gives Annual Report

Overall of critical defense operations in both Atlantic and Pacific Ends the Navy's air branch soaring rapidly for any task that may fall to it, the annual report of Admiral John S. (Jack) Towers, chief of the Bureau of Aeronautics, Navy, indicates. The total is 12,000 planes.

The Navy acquired 1,200 new planes and wingships with some parts during the year, which

brings with only 100 new acquisitions during the previous year, and the carrier planes now make full force of the expansion program becoming effective, it is reported.

To keep pace with emergency demands, many aircraft, including both carriers and land-based, have been replaced as the emergency has developed, the new and more modern equipment reflecting generally the techniques used in the war. The new equipment has better maneuverability, armor plate protection, self-sealing gas tanks, and better performances, while older planes which cannot be repaired are being taken out of service. They are being given as much of such improvement as is practicable.

New aircraft performed 30 percent more flying hours in the past year than in the preceding year, and in the last 12 months, 25,000 flights, the majority of which were of uninstrumented techniques. Training test and acceptance units are now operating on land bases, at Norfolk, Va., and in the air, and delivery of nuclear new planes and equipment.

All pilot training facilities are operating at full capacity, and each has been able to increase the number of students and flight personnel that received earlier.

The current program is now thoroughly planned to expand the present training facilities, to permit further development, including an outstanding type of naval and drive-in bases, and part the flight training with contractors under various types, especially the use of surplus aircraft, and expanded knowledge, a goal of the Navy. In developing saturation, it was stated, particular attention long paid to heavier and improved armament, details of which are not now public.



Exquisitely clean design of the North American "Mustang" fighter is evident in this striking photo during a test flight before delivery to England. U. S. Air Force version is designated P-51.

AAF Takes Highschoolers For Bombers, Navigators

Loosening restrictions to permit both school graduates of accredited schools to operate the Air Force's newest bombardiers and navigate long range flights, the Army Air Forces' combat training program expected to give the Air Corps 10,000 or more specialized crew members from similar services by the end of the coming year.

Previously, Air Corps navigators and bombardiers were required to have at least two years of college training or be able to pass a special Air Corps examination. Also, in the past, the Air Corps had been so rigid in its requirements that, in addition to permitting high school graduates, who must be between 18 and 21 years old, and able to pass as Air Corps intelligence train, to train for

This great expansion in personnel, it is being thought, the present level of 150,000 enlisted men and 30,000 flying officers and enlisted in training.

Flight training will last 30 weeks, and can consist of 15 different variations—from 8 to 30 weeks. No formal education is required for the latter courses which will take out additional months of training, and will include paratroopers, weather observers, electronics, instrument mechanics, radio operators and mechanics, night-fight instrumentation men and similar technical experts.

B-15 Accepted

After 45 hours of flight training, 16 more than required, the Douglas B-15 was officially



North American B-25 medium bombers lined up at Los Angeles airport just before takeoff flight to join Air Force squadrons in Georgia.



LGA TWA FIELD—World's greatest airport, second of commercial and international airlines. More than 3000 planes are handled at terminals and service at New York's Bellmead Field.

WHO WILL BE THE KEY MEN OF TOMORROW IN AVIATION?

AVIATION becomes more important, more interesting and more technical every day. The great future of the industry becomes ever more clear to foresighted men. Aviation will call increasing numbers of gifted, ambitious young men into its service. It will treat well those who enter their careers with a sound, thorough technical education.

Competition for the high places in the industry will be keen, as it is in all walks of life. Yet few fields indeed can offer the same scope, the same opportunities or the same security as will aviation over the next generation, and longer.

It has not been hard for our schools to attain the impulsion to offer "quick" or "easy" courses in aeronautics. For our single purpose is to train the key men of tomorrow in aviation.

You are cordially invited to send for full information on our courses, faculty and equipment. For entrance a high school education, or equivalent, is required. We will gladly send you our catalog on request.

J. S. Jones
President

The Future of Aviation

"The exhausts military and public service of transportation continue increasing demand which will increase rate for longer flying planes. Maintenance and lubrication and antifreeze will require constantly greater skill. It is a necessity for maintenance men to have a knowledge of sound mechanical training."

C. B. Stoen President
AMERICAN AIRLINES



Complete technical courses in aeronautics

Weatherhead

HAS AN IMPORTANT PLACE
IN HEMISPHERE DEFENSE



PRESERVED with years of experience gained in the world's largest manufacturer of flexible metal hose and fittings, Weatherhead has a new task. Weatherhead will be the selected source for the aviation industry when it comes to supplying the materials for mobile requirements.

For its diversified operations, Weatherhead's facilities are located and most extensive. To meet plane requirements, Weatherhead has concentrated with the Army Air Corps, the Navy, and the Air Force. Weatherhead's special aircraft hydraulic-developer vacuum applied parts that enables each type of aircraft to function in complete safety. The development of the latter has been made possible by the British.

Stainless Weatherhead engine parts are manufactured to the highest standards. These components are required as aircraft powerplants. Gears, cones and combinations are made to special orders.

The aircraft pneumatic facilities are designed to help win the National Defense Program. Your inquiries are invited.

THE WEATHERHEAD CO. • AIRCRAFT DIVISION
Main Office: Cleveland, Ohio.
West Coast Office: San Francisco, Calif.



WEATHERHEAD

Consolidated Contractors To Valve Aircraft

Early last month, Vulco Aircraft, Inc., of Southern California, announced details of a plan to acquire a 50 per cent interest in Consolidated Aircraft. The commanding interest is represented by \$46,000 shares of common stock of Consolidated held by Major General Fred F. Frazee, president of the company. The acquisition will involve a series of transactions, but the net cost to Vulco for the Consolidated shares was slightly over \$100,000.

Word spread throughout the country that Major Frazee had been forced out of Consolidated by the Administration, which had last recently succeeded at Senate Hearings on the defense budget. A statement, saying that this was not the case, but the merger was a natural one, that the Army and the Navy had aided the deal, did not become available until a week later. The new management said that Frazee would remain to date a salaried consultant at \$60,000.

The Vulco group needs nearly 10,000 workers. At the present time it has a backlog of some 12,000,000 in orders for its P-72 trainers, its Vanguard single-engine fighter and its single-seat fighter-bomber. The first 100 of the latter two are being made for the British.

Consolidated has \$1 billion dollars in orders for two new aircraft, the P-80 and the P-81. Deliveries for Britain, the PW-4000 Convairs for the U. S. Navy, and its two-engined bombers, the PB4Y Cruisers for the Navy and the British.

Industry Next Build 100,000 War Planes In Next Two Years

Washington (Aviation Bureau)—Col. John H. Joseph, president of the Armed Forces Chamber of Commerce of America, told members of their association that the industry this year is producing nearly 80,000 military planes, and that it will be called upon to put out nearly 100,000 warplanes during the next two years.

The dollar volume of more than one and a half billion dollars in production of planes, engines and propellers in 1941 is about triple that of last year. The production rate is rising

month by month. Our engine plants have now reached a monthly production rate of nearly 100,000 horsepower, and the monthly rate of the aircraft is increasing to 100,000. Peak production of 150,000 hp monthly will be reached in 1943. In presenting the present rate to were then asked:

"Our engine, engine and propeller plants have increased the number of employees from over 350,000 a year ago to about 450,000 at the present time. We are increasing the air force in the United States, Britain and other governments with more than 20 different types of men and women."

Major Frazee has every reason to believe that an annual production rate of 80,000 planes will be reached sometime next year," Col. Joseph said.

Lockheed Hangar

Believed to be the largest flight service hangar in the United States, Lockheed Aircraft Corp. commenced work Dec. 1st on a three-story building at its plant at Lockheed Air Terminal, Burbank.

With a floor area of 100,000

sq. ft., the new hangar is expected to one and one-half times its capacity.

The main hangar, 100 ft. long and 20 ft. wide, is designed for a propeller aircraft holding a maximum load of planes on all of our platforms," said Wendell S. Wright vice president of the corporation and general manager of the Aviation Division.

"Extremely important,"

he said, "is the fact that

the new building

will be equipped

with modern

facilities.

The new building

will be used for

storage, repair and

overhauling of

aircraft."

With aircraft performing a

short distance role in our war

zone, we are doing every

possible to increase our

output of planes on all of our

platforms," said Wendell S.

Wright vice president of the

corporation.

"Extremely important,"

he said, "is the fact that

the new building

will be equipped

with modern

facilities.

The new building

will be used for

storage, repair and

overhauling of

aircraft."



Some of the 10 assembly lines now being operated in Curtiss-Wright's two plants at Buffalo, where production of B-47s is approaching peak. A line of B-52 observation planes is at work.

Curtiss Fighter Output Reaching Peak

Shortly approaching a production peak in the low loss fighter aircraft division, Curtiss-Wright's two plants now in operation in the two plants.

Increasing numbers of Curtiss Hawk 80s, pursuit and escort fighters, and the first for the U. S. Army Air Forces have been turned out, together with Hellcat fighters for Great Britain's R.A.F. The Hawk Hawk and Kitefights are under design and pre-production.

"With aircraft performing a short distance role in our war zone, we are doing everything possible to increase our output of planes on all of our platforms," said Wendell S. Wright vice president of the corporation and general manager of the Aviation Division.

"Extremely important," he said, "is the fact that the new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

The new building will be used for storage, repair and overhauling of aircraft."

</

Largest Plant Producing Dive-Bombers

The enormous new aircraft manufacturing plant erected by Curtiss-Wright Corp., Alameda Division, at Port Chicago made its debut last week with the first successful test production of dive-bombers for the U.S. Navy. On display was the fleet of the Navy's newly designed Curtiss SBD-2 dive-bomber. This latest design type, used in the famous carrier battleship-based surprise in the world.

Second of three Curtiss-Swift units rushed to complete manufacture of the first two aircraft prior to completion of the plant, it contains 35 acres and was erected in 145 days at a total cost of \$14,000,000. The plant, which now employs approximately 3,700 persons, will eventually turn out 100 aircraft per month. Curtiss aircraft units completed in March, and third mass production is due in April.

The California factory is the first fully integrated Navy factory working entirely on U.S. Navy contracts to be completed, and also the first major aircraft manufacturing plant ever erected during the present emergency to engage solely in production of aircraft types.

The recently developed Curtiss SBD-2 dive-bomber, which has been built, entered the market first for dive-bomber to the world by Curtiss-Wright and Navy engineers, is also in production at the California factory.

Paul A. L. Clegg, B. W. Tamm, chief of the Bureau of Aeronautics, U. S. Navy; William Gates, assistant secretary of the Navy for Air; and Merrill C. Meigs, chief of the Aircraft



Biggest aircraft works at Alameda. New Defense Plant Corp. building in hangarous provides 400,000 sq ft for manufacture of aircraft. Shown here is Curtiss dive-bomber aircraft on great assembly dock is destined to support the right of the Curtiss machine shop and airplane parts plant.

Force, had paid the plant's original subcontractors to build the aircraft. Since that time, they could have turned over their resources for the advancing of a contract. Third, they could hand together under the sponsorship of a larger organization.

Meanwhile, in the military services, single-handedly or spontaneously and expressively, to handle their press contracts, the third plan was adopted by the Army and War Department.

The weather engineer present at a meeting to consider this management agreed spontaneously to merge all along with the Army and send their report to it.

Mass Fly-away

Third to support the Army's "Keep 'em Flying" recruiting campaign was organized Dec. 1st, a public service. Every aircraft and military aircraft was raised at the West Coast Post of the Air Corps Flying Command, Long Beach, Calif., on November 22nd. While no separate organization was formed, the members of the association, as follows: "Since this area we were advised that small balloons could strangle along in three ways

baby balloons, held in the nose, wings, engine, propeller, tail, engine, tail fin, rudder, single-wing, power, tail, in the canopy, and the Lockheed 44 twin-engine interceptor fighter, tail, both. The first and widest method is an effective demonstration of the capabilities of the Republic F-4U Corsair to the National Defense program."

Airplane Wheel Balancer

New component to bring increased in the aircraft area by E. G. Parker assisted with L. E. Wartford of the Maitland Products Co. Both men have spent upwards of three years developing and making a new device, M. balancing airplane tires.

During the past 30 days a test unit has been completed with the help of the Maitland Products Corporation, Los Angeles, Calif., who are making the endearing transport controllers, during which a number of tire types were placed in status and dynamic balance, those run in the same manner from speeds of 100 mph, the solution being checked out 125-130.

It was necessary to add or subtract one weight from any of the three tires about once every 1000 rpm. These tests showed certain wear, such as "wheel spots" which are usually caused by "over-speed" due to the manner in which the tire is balanced. It was found that the Air Corps had difficulty in successfully balancing aircraft wheel assemblies. Among tests for this not having been accomplished previously was that of an entirely suitable method of weighing balance weights, desirability of which

interchangeable bearings, valve and wheel instead of armature, and lack of suitable balancing apparatus.

Assembly Lines

By Robert Clegg

A world record for bombardment aircraft was attained, Glenn Martin officials claim, when a "Baltimore" medium bomber was put into a test flight by Bill D. Edwards, model a speed of 500 mph.

The plane was taken to 50,000 feet and showed a reading on the altimeter indicating of 400 mph. The record, however, was set at 495 mph, Edwards said, and readings are the best that static, let me say, can be obtained.

These figures go to work for

North American Aviation of Texas. They are the first mass

factory produced in the first World War, with the aid of seven anti-submarine manufacturers, will be shifted up to the next five months to Pratt & Whitney, the company says. The company already is working on the elusive subcontractor assignment at that plant.

The 16,000-square-foot Cub rolled off the assembly line at the Lake Haven Plant, plant of Payne Aircraft Corporation, the week of November 26, and comes directly to the Martin Assembly line. The first 100 aircraft are now installed in the plant. The first Cub will fly there September 10, 1942.

First S. B.25s designed. The greatest door handles have been a selling point Northrop's Hawker 1100 production line, an 11,000,000-unit over the three months since the first aircraft was delivered.

Northrop will be in production at the end of June on models aggregating 100,000,000 units for their own designs, with a backlog of orders now 470,000,000.

Unusual use of bombs were made by the B-17, world's largest land plane. The plane now mainly carries bombs with the exception of a few, in addition to carrying 1000-gallon gas tanks, making, with the damage bombs, a gross of 160,000 pounds.

Scandia Aviation Corporation has started work on the new multi-model factory building at Blue Ridge, N. J., totaling 134,000 square feet in plain space over a mileage of which 10,000 ft. will be devoted to maintenance manufacture.

Air Corps officers recently paid off Lockheed and Vultee plants making bombers and total weight of aircraft produced by the air force is the air force. Col. A. Robert Glavinich of Army headquarters in Washington. That part of a new general policy just initiated by the Air Corps in speed up production by

making unchangeable earnings, value and weight instead of armature, and lack of suitable balancing apparatus.

The oldest aircraft ever was christened in a short ceremony at the Douglas Santa Monica, El Segundo and Long Beach, California plants on December 10. Only the President and his wife were invited, and the guests were few, to receive, in addition to their weekly pay, up to \$1000 in bonus "ration" for a total of \$20,000 during the year, including special training participation pay increments and seniority benefits.

1942 present year, is Reynolds Metal Company's claim to distinction, produced at its Los Angeles aircraft plant, the first aircraft to be produced on May 28. Aluminum that same sheet is 5 percent more expensive than

Executive Management Board of Aero Industries Technical Institute

Robert E. Gross
Executive Director
Research Department

C. A. Van Dorn
Vice-Chairman, General Department



Moses Chase, Secretary and Vice-Director of the Board of Directors and the Advisory Board of Aero Industries. Vice-Chairman of the General Department. He has been closely involved with the Institute's operations as chairman of the defense panel, planning and budgeting.

Paul H. Clegg, Mr. Roosevelt and Mr. Van Dorn will report the entire operation of Aero Industries. Retired field officer.

During the present feasibility of these excesses with present personnel needs and expected future requirements, Aero Industries' General Department will use the industry's efficiency better.

Board of Directors	
Robert E. Gross	John S. Northrop
C. A. Van Dorn	Ed Dornell
James I. McWhorter	Thomas G. Ingley
Sylvia Y. Stevens	

Aero Industries Technical Institute

2261 West San Fernando Road, Los Angeles, California

Aero U.S. operates as an independent organization and is affiliated with other schools.

3000 hours of instruction

ABROAD INSTRUCTORS AND REFERENCE INSTRUCTORS

Including 12 Month Branch Institutes Directly Approved by U. S. Board of Education Administration



Eastern District automotive area and the West Coast is devoting a regular "Mobile" bus service to passenger automobile advertising activities. In aircraft plants, First American Service, Inc., from Memphis, Tenn., and the Western Auto in Oregon, Long Beach, formerly federal business special has more than 1000 cars shown, with end doors, raised roofs and roofs, are in service.

AVIATION ABROAD

Canadian Aviation News

By James Marten

Over 16,000 planes are now being built across Canada for training and defense needs. The total, at the end of March, Ralph F. Bowes, director general of aircraft production, stated in Montreal last Friday. The cost of preparing, maintaining and operating these aircraft, plus parts, is estimated to total \$100,000,000 annually, he stated. To date a total of 12,000 aircraft are on order in Canada.

An announcement made on the same day in Ottawa reported that Britain's Avro, Westland, with National Steel Car Co., Toronto, to manufacture Martin B-57 transonic bombers have been awarded, and negotiations are under way for Lancaster four-engine bombers. Douglas, Canadian Steel Car, the plants of Associated Aircraft Co. at Toronto, and the Canadian Car and Foundry plant at Fort William, Ontario, will manufacture Lancaster bombers. In making the announcement regarding the construction of the B-57 bombers, Minister of Supply Maurice L. B. MacKenzie said the plane is being redesigned in the United States, and that the British government has asked the Canadian government to make the Lancaster bombers available to the Lancaster production has started.

It is reported in Ottawa that under the post-Canada-United States Formosa Defense Board a string of air bases has



Metals drums, which cracked again down within British bases in Africa, had wooden propellers. The bases were built in makeshift and some drums for lack of tools.

On Schedule

On the last word in press, war books out in the Pacific, another British American airline connection not only in that area but all over the globe. One of Pan American's transports, the Boeing 314, which was en route to Asia, recently landed at Yerresville, Rhodesia, because of bad weather and had to turn back. The 314, which had been flying nonstop from San Francisco, California, across the South Pacific, across the River and other routes, left London, at Port Victoria, New Zealand, on Wednesday Island, Alcatraz Bay in the Queen Charlotte Islands, Canada. Both Delta and Pan American have been unable to find suitable alternate routes, and never have been able to find alternate northern British Colonies to the Yukon and Alaska.

At the end of 1945 Canada will have 16,000 aircraft, according to the British Ministry of Supply. British Airports in the United States, told a Montreal audience late in September. This is a greater number than has ever been assembled.

In connection with licensing these aircraft, Air Marshal C. F. Powles stated that "the fact that this country, at the present time, is the only one in the world which keeps the most powerful air force in the world, is using this influence to establish such routes for its international services as would give it mastery of the air at the conclusion of the second World War." Recent decisions by the CAB have not been favorable to the airlines, but nevertheless, the influence of this government, see all falling into the laps of international air transportation. Most of these new routes are without present commercial value, but their strategic value is evident, and they form the basis for future development on a grand scale.

Quite evidently that country has followed a more realistic policy towards its international airfares than the English, even though war hampered them likewise. Little has been said or written about it, but it has been quite apparent that the English, in their desire to keep up with the Americans, have reduced the fares of all commercial aircraft. It has been reported that only a certain flight inland the service with military men who prevent the usual of commercial operations has prevented a complete cessation of civilian airfares.

Although in this country aircraft have been requisitioned by the government for British aid, apparently none have been taken away under commandeering by the Army or Navy for transport of freight or personnel. The American forces, with the exception of the Air Corps, have concentrated for years on certain planes, and through production of civilian airfares is limited. U. S. aircraft have not been brought to a new standard. There is a large fleet of Douglas B-17 aircraft here, which admittedly in lessening that nation in the Air Corps, and will waste the price of construction to convert planes. This fact, however, has given us "in" to the British, and would probably have served the purpose of desert water carriers, cargo and material transports better and cheaper than the DC-3 and DC-4 that have been converted to this use.

Taking all circumstances into account, it appears neither right nor fair to criticize this country for extending its airfares all over the globe—it should instead be praised as a habbit move, maintaining communications vital to the democratic world, while no other country is able to do so. It does not seem right to say that this will undoubtedly confuse any other country from expanding. Air transportation is still in its infancy.

PAN AMERICAN WEIGHS BIG CLIPPERS WITH BLACK & DECKER LOAD-O-METERS

PHOTO COURTESY OF PAN AMERICAN AIRLINES



PAN AMERICAN CLIPPER—one of a fleet that flies the Atlantic and between the main routes throughout the world.



BLACK & DECKER "LOAD-O-METER" is placed on big items like new machinery for hospitals. This is the first time it has been used to weigh a large object.



BLACK & DECKER "LOAD-O-METER" is placed on big items like new machinery for hospitals. This is the first time it has been used to weigh a large object.

Because of the accuracy, compact size and easy operation of Black & Decker Aircraft "Load-O-Meters," Pan American Airways depends upon them in determining weights of giant Clippers for aerial Card Assurance Authority Operations Certificates.

The large horns are placed upon beaching gear, packed up, then weighed with four Black & Decker "Load-O-Meters"—one on each side of the hull. A scale of the "Load-O-Meter" marks, and the total, accurate weights are automatically shown on the dial. No special installations are required. Weights determined are within 1% of 1% of absolute accuracy.

Black & Decker's Aircraft "Load-O-Meter" is a portable device that weighs any type ship and in fact to calculate cost of gravity. The complete Black & Decker Unit consists of "Load-O-Meter," gas or ramp and hand carrying case. Weighing only 120 pounds, the instrument is easily carried about the airport or plant. Capacity of individual units 15,000 or 20,000 lbs. To illustrate Aircraft Load-O-Meter folder and demonstration, write The Black & Decker Mfg. Co., 716 Pennsylvania Ave., Towson, Maryland.

BLACK & DECKER

LOAD O METER



For the Engineer



SLEEVE Bearings of today are precision-made products. They more than prevent wear and reduce friction—but definitely aid the performance of a motive unit. Accordingly, they should be designed and produced to fit the individual application. Only by so doing can you expect to gain the maximum life and service.

It is an easy matter to build this type of bearing performance into your product. Simply determine all the factors that in any way effect bearing operation.

Johnson Bronze can help you in this. We have prepared a vast array of Data Sheets. These cover practically every phase of sleeve-type bearing—such as Lubricants, Design, Alloys, Physical Characteristics, etc. The complete set—in a handy file folder—is yours for the asking. Why not write for this information today?

JOHNSON BRONZE COMPANY
Sleeve BEARING HEADQUARTERS
620 SOUTH MILL STREET • NEW CASTLE, PA.



AVIATION PEOPLE



For his development of the superchargers used in the B-17 Flying Fortress, **RALPH D. ROSS**, shown here, received the Distinguished Service Award of General Electric, and became the first member of the Geller Trophy for 1941, jointly with the Army Air Corps.



FREDERICK B. COBURN, vice president of Air Associates and former general manager of Aviation Corp., designed and built the Naval Aircraft Factory Flying Navy service in the World War.



Through special assignment with Vega Airlines, **FRANK D. BRINNING** was appointed supervisor of maintenance. **James G. Maynard**, vice president, has been appointed to join Northwest Airlines.



GROVER LOENING is associated with All American as engineer-in-chief and director of flight testing. He was previously president of Marmon Helicopter Corporation.



C. H. KALTWAHLER, senior vice manager of **Walter**, Illinois, engineering vice president and manager of Fleetwings. He was previously president of Marmon Helicopter Corporation.



AVIATION keeps the new management at Thompson Products, Inc., up-to-date on all developments in the aircraft industry. At the new company are **J. M. L. M. OGLE**, executive vice president; **A. T. GOLDFELL**, vice president; **A. G. WRIGHT**, secretary-treasurer. These officers continue to serve the parent company in the same capacities, and **J. D. Wright** is also appointed vice president and general manager of the new company. **Harry D. Kuhn** is promoted from chief engineer of the parent plant to director of engineering for both the Cleveland and Elyria plants. Plant manager is **E. A. McRae**, many years manager of the main plant.



Thompson Allevators Products Co., now subsidiary of Thompson Products, Inc., has assumed the name of its new division, **Allevators**. **John G. Gleaves**, executive vice president of the new company are **J. M. L. M. OGLE**, executive vice president; **A. T. GOLDFELL**, vice president; **A. G. WRIGHT**, secretary-treasurer. These officers continue to serve the parent company in the same capacities. **J. D. Wright** is also appointed vice president and general manager of the new company. **Harry D. Kuhn** is promoted from chief engineer of the parent plant to director of engineering for both the Cleveland and Elyria plants. Plant manager is **E. A. McRae**, many years manager of the main plant.



After six months leave to serve in the U.S. Army, **A. G. WRIGHT** resumes his post of director of advertising with **General Aircraft**. His leave with **General** ended in 1948.



After six months leave to serve in the U.S. Army, **E. A. McRae** resumes his post of director of advertising with **General Aircraft**. His leave with **General** ended in 1948.



After six months leave to serve in the U.S. Army, **J. D. Wright** resumes his post of director of advertising with **General Aircraft**. His leave with **General** ended in 1948.



ROBERT F. GORDON, an aeronautical engineer at **Boeing** Aircraft, joined **Curtiss** as engineer in 1928. Between 1930 and 1932 he was assistant director of research and development. **J. M. L. M. OGLE** was recently made director of engineering at **Vultee** Aircraft.



A month ago **November** **J. H. BURGESS**, Jr., now manager of **Boeing** Aircraft, joined **Curtiss** as director of production. He came with **Boeing** Manufacturing Company for 20 years. In the last 16 months he was vice president and general manager of **Boeing** Aviatlon Corp.



H. H. BURGESS, Jr., now manager of **Boeing** Aircraft, joined **Curtiss** as director of production. He came with **Boeing** Manufacturing Company for 20 years. In the last 16 months he was vice president and general manager of **Boeing** Aviatlon Corp.



EDWARD G. KERN joined **American Airlines** as West Coast publicity director in 1938, advanced to regional director in 1940, and to national director, regional director, with **Chicago** headquarters.



EDWARD G. KERN joined **American Airlines** as West Coast publicity director in 1938, advanced to regional director, regional director, with **Chicago** headquarters.

YESTERDAY . . .

We don't live on yesterday's records. But after all, it should be of intense interest to everyone who does fly or intends to fly to know that Continental Red Seal Engines hold all important world records in the small plane class —

New, 1932 — Johnny Jones non-stop trans-country coast-to-coast flight

Oct. 12, 1937 — Henry S. Chapman non-stop flight New York to New Orleans

Sept. 27 to

Oct. 28, 1937 — Clyde Schlepper and Wm. Carroll non-stop endurance flight of 726 hours in the air

S. J. Welz — National 100 kilometer speed record for light planes — 118.746 M.P.H.

Firesstone Trophy Race

1940 — Continental Powered planes took 1st, 2nd, 3rd, and 4th

1941 — Continental Powered planes took 1st, 2nd, 3rd, 4th, 5th, and 6th

TODAY . . .

The great Continental Plants are keeping pace with defense and keeping faith with customers. This is a record we are really proud of.

TOMORROW . . .

Tomorrow of course is a new story — a story of new opportunities — of new products and new accomplishments. However the valued experiences of yesterday and today have forged a lasting foundation to insure that Continental Red Seal Engines will always keep pace with greater things to come.



Continental Motors Corporation
MUSKEGON, MICHIGAN

United Aircraft started Wall Street out of its lethargy recently by purchasing from Major Brothers & Flors a controlling interest (44%) in a company known as Consolidated Aircraft. Total purchase price will be \$1,000,000. A \$1,000,000 cash payment is called for by the agreement with the balance payable over time in installments. Total cost of the acquisition of the Flors interests will give United Aircraft control of the Curtiss Wright Corp. Meanwhile the warrant companies had a prominent role among the long list of industrial concerns that declared dividend dividends while the air transport units again had a very modestly minimum stock.

In order to finance the Consolidated stock purchase, United expects to sell \$1,000,000 of convertible preferred stock to public. An additional \$100,000 share of stock will be sold to Aviation Credit Corp., which is to share balance of the cash required for the transaction will be obtained from bank loans or from corporate funds. The president of the company will be headed by North & Co. and Kremml & Co. of New York.

United Aircraft Corp. will finance a major expansion and development program for its products and services through the issuance of new convertible convertible preferred stocks. Company stockholders will be entitled to vote on the issuance of up to 210,000 shares on the basis of one preferred share for each 20 shares of stock now held. Stockholders also will have voting rights to approve an increase in the number of shares outstanding from 3,000,000 shares to 4,000,000 shares as well as the creation of 500,000 shares of non-voting preferred. The amount of the proposed distribution will be determined and agreed upon shortly.

Alfredsen companies probably will offer any other industrial group the largest amount of non-voting dividend payments last year. The following partial list of

By Raymond L. Headley

the activities of one of the largest and one of the oldest aircraft manufacturers in America is interesting. United Aircraft Corporation, the aircraft division of Illinois Central Air Lines, has purchased working control of Consolidated Aircraft — company twice as old. The United-Corporation unit is the result of a combination of diversified interests of about \$1,000,000,000, approximately the same as the Curtiss Wright Corp. Meanwhile the warrant companies had a prominent role among the long list of industrial concerns that declared dividend dividends while the air transport units again had a very modestly minimum stock.

Non-voting dividends payments per share in 1941 and 1940 show the benefits that stockholders received last year from venture capital placed in selected securities in the lower prices.

United Aircraft Corp. 1941 1940
Aviation Supply \$0.00 \$0.35
Aviation Corp. 0.05 0.05
Consolidated 4.00 0.00
Curtiss Wright 1.00 0.00
Harrington 1.00 0.00
Martin 0.00 0.00
Navy America 2.00 1.00
Powers B 3.00 3.00
United Aircraft 4.00 0.00

United Aircraft and Vultee have announced a new feature in association financing by offering to the public fixed income securities which will bear convertible on certain principal amounts of the stock market participation of the common shares. Outside of Curtiss-Wright, Consolidated and a few others, the aircraft industry has been slow in general to issue convertible securities. The tax is being waived on newly-purchased shares of the common stock in an industry that has been singularly

non-existing. Last year, the stock market participation of the common shares outside of Curtiss-Wright, Consolidated and a few others, the aircraft industry has been slow in general to issue convertible securities. The tax is being waived on newly-purchased shares of the common stock in an industry that has been singularly

preferred. The United financing proceeds will be used to increase working capital and to acquire additional assets, including the production of non-voting preferred stock, which will be offered at \$12 a share, will be used to pay off bank loans of \$10,000,000 and the balance of over \$500,000 added to working capital.

Other aviation holding interests include Illinois Central holding interests by Lockheed Aircraft from \$10,000,000 to \$100,000,000 in 1941, and the establishment of an additional \$75,000,000 line of credit. On the other hand Transoceanic and C. W. Wilson Air Corp. paid out \$1,000,000 in dividends during the year, leaving a total of \$100,000 outstanding.

Douglas Aircraft reported sales of \$10,000,000 in 1941, and \$25,000,000 — the peak year. In contrast, sales were \$10,000,000 for the first nine months of 1941 and the third quarter will sell over \$100,000,000. The company has a backlog of \$100,000,000. Frank D. Whitney division of Douglas Aircraft Corp. is running flying times as large as it was two years ago.

Piper Aircraft has completed its 100,000th cabin airplane — the first time any aircraft manufacturer has produced such a number of one basic type of airplane. Current output is approximately 4,000 units a month, with projected capacity anticipated to be in the neighborhood of 10,000 planes a year.

Defense orders of the light transport type include a substantial number of high-wing monoplanes distributed among the following contractors, Avro Canada, 204,752; Fairchild Aviation, 161,412; and Piper Aircraft, 102,887.

Now and Then . . . Richard A. Egan, Jr., of the Reynolds family, San Joaquin, has acquired a majority interest in the Pacific Aviation Co. of Pasadena, Calif. Egan's ownership role in 1941 was estimated as 75% of the stock held by his father, Charles Egan, who died more than 80 years before last year. American Airlines carried the President-Senator passenger in October. Senator George H. Smathers reported a mobile order for eight engines for the Dutch East Indies. F. M. Dillard is the new secretary-treasurer of Adel Petroleum

Current Earnings Report

Company	Period	Profit per share (\$100)	Net sales (\$100,000)	Net loss (\$100,000)
Bachmann	Home Dec 30	\$0.100	\$1,200	\$1,120
Brown Bldg.	Home Dec 30	\$0.125	\$1,200	\$1,120
Consolidated	Home Dec 30	\$0.100	\$1,200	\$1,120
Curtiss Wright	Home Dec 30	\$0.250	\$1,200	\$1,120
Eastman Kodak	Home Dec 30	\$0.100	\$1,200	\$1,120
Ford Motor	Home Dec 30	\$0.050	\$1,200	\$1,120
General Electric	Home Dec 30	\$0.050	\$1,200	\$1,120
Harrington	Home Dec 30	\$0.100	\$1,200	\$1,120
Hoover	Home Dec 30	\$0.050	\$1,200	\$1,120
Kodak	Home Dec 30	\$0.100	\$1,200	\$1,120
Lockheed	Home Dec 30	\$0.100	\$1,200	\$1,120
Northrop	Home Dec 30	\$0.100	\$1,200	\$1,120
Powers B	Home Dec 30	\$0.100	\$1,200	\$1,120
Transoceanic	Home Dec 30	\$0.100	\$1,200	\$1,120
United Aircraft	Home Dec 30	\$0.100	\$1,200	\$1,120
Vultee	Home Dec 30	\$0.100	\$1,200	\$1,120
Wright	Home Dec 30	\$0.100	\$1,200	\$1,120
Yerkes	Home Dec 30	\$0.100	\$1,200	\$1,120

See Box

Always ready FOR ACTION



...AMPCO AND THE AIRACOBRA

When duty calls—when the time for action comes—Bell Airacobra is ready. And so are the Ampco engineers who form vital parts in its construction.

Aircraft developing engineers know the best way to avoid breakdowns and failures in highly stressed locations is to use sturdy, non-corroding alloys from the Ampco foundries. In essence, they never fail.

That's why Airacobras equipment supplier—the manufacturers of Allison engines and Curtis electric generators—comes to Ampco for vital parts. That's why Bell Aircraft itself is making headlines now. AMPCO METAL hot stock is in every stage. All three of these manufacturers demand proven materials—alloys that can tolerate extreme punishment without damage. In Airacobras, they find exactly what they need.

Thirty-three different models of aircraft are Ampco-equipped—evidence of Ampco's ability to give service where no one else would. If you're interested in our products, contact us. We'll be happy to help you.

AMPCO METAL, INC.
Dept. A-141
Milwaukee, Wisconsin



AMPCO METAL
The Metal Service Company

Cop of Burkhal, Cal., whose dividends for the October quarter totaled \$1,114,000. G. W. Clark Co. of Chicago has a balance of \$48,000. Also, 118 employees to the commercial aviation firm will still be with the group in a mounting rising rate and team. Costs are up 10 percent, but to meet 200 percent, personnel cost 20 percent, personnel cost 20 percent, and manufacturing expense 102 percent in 1941.

Continental Motors eliminated 100 long term RTT jobs above 1940.

Worthington Airplane

is reported as having a long-term expansion program which will call the attention of its owners to Alaska and the Desert Southwest. Airplane is estimated to come to market in the fall of 1942 at around \$90,000.00 a month in the spring.... Aircraft equipment represents 95 percent of total volume of the Knapp Corp. Div. of the company. Production of the air is 100 percent after the emergency is over.

John W. Newey has been appointed manager to the president of Knapp Co. Lewis is charged with the responsibility of continuing the business.

Franklin Aircraft Corp.

enlisted orders of \$10,470,000 on Sept. 30, 1941.

These experts to be represented by new directors, the present Board of Directors.

Pan-American Airways Corp.

plans to move its general offices to Washington. The cash amount of Lockheed dividends for 1941 is \$1,200,000.

\$4,500,000 for 1942.

For 1943, \$1,200,000.

For 1944, \$1,200,000.

For 1945, \$1,200,000.

For 1946, \$1,200,000.

For 1947, \$1,200,000.

For 1948, \$1,200,000.

For 1949, \$1,200,000.

For 1950, \$1,200,000.

For 1951, \$1,200,000.

For 1952, \$1,200,000.

For 1953, \$1,200,000.

For 1954, \$1,200,000.

For 1955, \$1,200,000.

For 1956, \$1,200,000.

For 1957, \$1,200,000.

For 1958, \$1,200,000.

For 1959, \$1,200,000.

For 1960, \$1,200,000.

For 1961, \$1,200,000.

For 1962, \$1,200,000.

For 1963, \$1,200,000.

For 1964, \$1,200,000.

For 1965, \$1,200,000.

For 1966, \$1,200,000.

For 1967, \$1,200,000.

For 1968, \$1,200,000.

For 1969, \$1,200,000.

For 1970, \$1,200,000.

For 1971, \$1,200,000.

For 1972, \$1,200,000.

For 1973, \$1,200,000.

For 1974, \$1,200,000.

For 1975, \$1,200,000.

For 1976, \$1,200,000.

For 1977, \$1,200,000.

For 1978, \$1,200,000.

For 1979, \$1,200,000.

For 1980, \$1,200,000.

For 1981, \$1,200,000.

For 1982, \$1,200,000.

For 1983, \$1,200,000.

For 1984, \$1,200,000.

For 1985, \$1,200,000.

For 1986, \$1,200,000.

For 1987, \$1,200,000.

For 1988, \$1,200,000.

For 1989, \$1,200,000.

For 1990, \$1,200,000.

For 1991, \$1,200,000.

For 1992, \$1,200,000.

For 1993, \$1,200,000.

For 1994, \$1,200,000.

For 1995, \$1,200,000.

For 1996, \$1,200,000.

For 1997, \$1,200,000.

For 1998, \$1,200,000.

For 1999, \$1,200,000.

For 2000, \$1,200,000.

For 2001, \$1,200,000.

For 2002, \$1,200,000.

For 2003, \$1,200,000.

For 2004, \$1,200,000.

For 2005, \$1,200,000.

For 2006, \$1,200,000.

For 2007, \$1,200,000.

For 2008, \$1,200,000.

For 2009, \$1,200,000.

For 2010, \$1,200,000.

For 2011, \$1,200,000.

For 2012, \$1,200,000.

For 2013, \$1,200,000.

For 2014, \$1,200,000.

For 2015, \$1,200,000.

For 2016, \$1,200,000.

For 2017, \$1,200,000.

For 2018, \$1,200,000.

For 2019, \$1,200,000.

For 2020, \$1,200,000.

For 2021, \$1,200,000.

For 2022, \$1,200,000.

For 2023, \$1,200,000.

For 2024, \$1,200,000.

For 2025, \$1,200,000.

For 2026, \$1,200,000.

For 2027, \$1,200,000.

For 2028, \$1,200,000.

For 2029, \$1,200,000.

For 2030, \$1,200,000.

For 2031, \$1,200,000.

For 2032, \$1,200,000.

For 2033, \$1,200,000.

For 2034, \$1,200,000.

For 2035, \$1,200,000.

For 2036, \$1,200,000.

For 2037, \$1,200,000.

For 2038, \$1,200,000.

For 2039, \$1,200,000.

For 2040, \$1,200,000.

For 2041, \$1,200,000.

For 2042, \$1,200,000.

For 2043, \$1,200,000.

For 2044, \$1,200,000.

For 2045, \$1,200,000.

For 2046, \$1,200,000.

For 2047, \$1,200,000.

For 2048, \$1,200,000.

For 2049, \$1,200,000.

For 2050, \$1,200,000.

For 2051, \$1,200,000.

For 2052, \$1,200,000.

For 2053, \$1,200,000.

For 2054, \$1,200,000.

For 2055, \$1,200,000.

For 2056, \$1,200,000.

For 2057, \$1,200,000.

For 2058, \$1,200,000.

For 2059, \$1,200,000.

For 2060, \$1,200,000.

For 2061, \$1,200,000.

For 2062, \$1,200,000.

For 2063, \$1,200,000.

For 2064, \$1,200,000.

For 2065, \$1,200,000.

For 2066, \$1,200,000.

For 2067, \$1,200,000.

For 2068, \$1,200,000.

For 2069, \$1,200,000.

For 2070, \$1,200,000.

For 2071, \$1,200,000.

For 2072, \$1,200,000.

For 2073, \$1,200,000.

For 2074, \$1,200,000.

For 2075, \$1,200,000.

For 2076, \$1,200,000.

For 2077, \$1,200,000.

For 2078, \$1,200,000.

For 2079, \$1,200,000.

For 2080, \$1,200,000.

For 2081, \$1,200,000.

For 2082, \$1,200,000.

For 2083, \$1,200,000.

For 2084, \$1,200,000.

For 2085, \$1,200,000.

For 2086, \$1,200,000.

For 2087, \$1,200,000.

For 2088, \$1,200,000.

For 2089, \$1,200,000.

For 2090, \$1,200,000.

For 2091, \$1,200,000.

For 2092, \$1,200,000.

For 2093, \$1,200,000.

For 2094, \$1,200,000.

For 2095, \$1,200,000.

For 2096, \$1,200,000.

For 2097, \$1,200,000.

For 2098, \$1,200,000.

For 2099, \$1,200,000.

For 2100, \$1,200,000.

For 2101, \$1,200,000.

For 2102, \$1,200,000.

For 2103, \$1,200,000.

For 2104, \$1,200,000.

For 2105, \$1,200,000.

For 2106, \$1,200,000.

For 2107, \$1,200,000.

For 2108, \$1,200,000.

For 2109, \$1,200,000.

For 2110, \$1,200,000.

For 2111, \$1,200,000.

For 2112, \$1,200,000.

For 2113, \$1,200,000.

For 2114, \$1,200,000.

For 2115, \$1,200,000.

For 2116, \$1,200,000.

For 2117, \$1,200,000.

For 2118, \$1,200,000.

For 2119, \$1,200,000.

For 2120, \$1,200,000.

For 2121, \$1,200,000.

For 2122, \$1,200,000.

For 2123, \$1,200,000.

For 2124, \$1,200,000.

For 2125, \$1,200,000.

For 2126, \$1,200,000.

For 2127, \$1,200,000.

For 2128, \$1,200,000.

For 2129, \$1,200,000.

For 2130, \$1,200,000.

For 2131, \$1,200,000.

For 2132, \$1,200,000.

For 2133, \$1,200,000.

For 2134, \$1,200,000.

For 2135, \$1,200,000.

For 2136, \$1,200,000.

For 2137, \$1,200,000.

For 2138, \$1,200,000.

For 2139, \$1,200,000.

For 2140, \$1,200,000.

For 2141, \$1,200,000.

For 2142, \$1,200,000.

For 2143, \$1,200,000.

For 2144, \$1,200,000.

For 2145, \$1,200,000.

For 2146, \$1,200,000.

For 2147, \$1,200,000.

For 2148, \$1,200,000.

For 2149, \$1,200,000.

For 2150, \$1,200,000.

For 2151, \$1,200,000.

For 2152, \$1,200,000.

For 2153, \$1,200,000.

For 2154, \$1,200,000.

For 2155, \$1,200,000.

For 2156, \$1,200,000.

OPERATORS CORNER

N.A.T.A. Elects Officers

William A. Ong, first-time sponsor of Kansas City Mo., and most of his colleagues in the board of the National Aviation Association, were re-elected or re-elected to second terms by delegates attending the second annual convention held in Kansas City December 1 and 2.

Tom Van Duzer, Louis H. Beaman, Elmer North, John R. Stevens, and Ernest Turner, Indianapolis, Ind., were re-elected Members of the board reelected to office by the Kansas City delegation.

John M. Weller, Edward L. Leonard, Robert G. John H. Johnson, Louisville, Ky.; Bertrand Kline, Los Angeles, and A. A. Brewster, Mobile, Ala., were elected to the board for the first time.

Other newly elected officers are: James C. Moore, Captain Charles E. Moore, commanding officer for the USAF South region, and Major Edward G. Shultz, selected for the 32d region, MacDill, Fla. C. E. Moore, Kansas City, was re-elected to a second term.

The convention endorsed the McCarran-Kingbill bill, which would authorize the civil aeronautics administration to train women in aircraft under a plan similar to the one used for the CPT program. The delegation pledged the membership to support all John P. Hart's CPT efforts, and his congressional efforts were supported by Robert H. Knobley, assistant secretary of commerce, for training the idea of civilian pilot training. More than 200 non-scheduled commercial operators attended the convention.

Lanscome Enrolls Women In Ground Subjects

In recognition of the growing importance of women in national defense work, the Lanscome Flying Service, Inc., has opened an advanced flying school. A series of women students will be accepted for training in aircraft production and also for more advanced courses in cockpit and engine maintenance.

The first woman student, Mrs. Margaret Johnson of Denver, Colo., X-2, enrolled in November in the Master Mechanics course.

A survey made by the school during the summer months revealed a growing interest in employment of women in both airplane and engine plants. Listed among the 100 women who have fully advanced to advanced courses were wire drawing, gear passing, turning, assembly of small parts, probe drilling, inspection, parts installation and spot-

welding. The course fees, also, but the winter shortage of aircraft maintenance personnel has offset during November at the following amounts:

Albuquerque, New Mexico
Atlanta, Georgia
Charlotte, North Carolina
Jackson, Mississippi
Orlando, Florida
Phoenix, Arizona
Red Lake City, Utah
Rome, Georgia

The following will be put into CAA control during January, 1942:

Birmingham, Alabama
Boston, Massachusetts
Buffalo, New York
Des Moines, Iowa
Jacksonville, Florida
Knoxville, Tennessee
Kansas City, Missouri
Los Angeles, Calif.
Omaha Field
Louisville, Kentucky
Memphis, Tennessee
Milwaukee, Wisconsin
Nashville, Tennessee
Newark, New Jersey
St. Louis, Missouri
San Diego, Calif. (Lindberg Field)
Seattle, Wash. (Boeing Field)
Tampa, Florida
Wichita, Kansas

Towline Tests

Gilring aerotow continues to move forward in Southern California. Latest report is from the operations of the Pomona glider pilot school, being conducted at the airport. The rate of one year for each three months of actual experience qualified personnel on duty. Testers long taken over will be graduated length of towline.



Harvey Airlines, Commanders Bill Murphy and Gus Bringle at Sacramento City Lake, Calif. Commander Murphy is the RAF now the Brigadier RCAF to 4000 ft. and played golf for one hour.



Chart shows expansion of training at Craft Center Air Express. Center, which comprises 55 schools in five states, as end of November, training strength included 600 pilots, 400 mechanics, navigators and bombardiers, plus 210 students at replacement centers. These figures do not include business at Memphis and West Coast training centers.

Facilities for auto sheet glider training, G-1000, G-1000B, G-1000C and nosewheelers, resulted in altitude of 4400 ft. while testing behind an automobile on a 1300 ft. towline. This was with the tail up, when a radio was used to raise the glider to such an altitude, believed to far exceed any previous baseline altitude reached with a glider.

Western Wings

Western Wings, Inc., has been formed in Southern California and is engaged in aircraft maintenance and repair after the manner of the Bellanca plan. Started by employees of Western City Lines, traffic department, the shop is believed to be the only such organization of aircraft maintenance function to include A. Bellanca and his associates recommended from the ranks of Western City Lines pilots. The shop has purchased an inventory of "Cabin" parts.

It's up to you -



This torch of liberty is still held high and burns brightly over America. Gift of a people possessed by the aggressor, our Nation of Liberty now, more than ever, stands forth as a beacon of hope in a world at war. To each and every one of us it gives the privilege and the duty of keeping freedom's light alive.

On land, sea and in the air, American guardians of liberty and fighters for freedom everywhere are poised on the common cause. West Boeing, 40,000 strong, are doing our share in providing the tools to freed our job. In forged, founders and shape throughout the Nation other Americans are doing their share.

But men and women behind me about and men behind the guns at ships, tanks and airplanes cannot complete the task alone. They need your help, support and confidence, to do your service at government. America's aircraft industry has tackled history's biggest job. It can be done, if it is to be done. It's up to you to see that it is done. It's up to you to see that it is done well, successfully.

George S. Baugh
President, Boeing Aircraft Co.

Suppose They Bomb!

Several booklets and pamphlets have been written to help the factory manager.

MANY a manufacturer finds that thought protecting itself and workers what steps he can take to protect his plant and his property. The Division of State and Local Government of the Office for Civilian Defense Management has published a booklet called "Protective Countermeasures," prepared by the War Department after study of the latest information available from European sources, and used by the Office of Civilian Defense.

Part I considers the weapons against which protection must be provided, describes their action, their objectives, and the type of damage which they are likely to inflict. A section on Building Failures (with tables on impact, and one on depth of control) and a discussion on the physical effects of bombs on building. Part II compares shell with weapons of defense. Concerning protection of buildings it is pointed out that framed buildings of steel or reinforced concrete are relatively less affected even by direct hits than those of solid-wall construction. Surroundings with air of deflagration are to be avoided; structures subject to natural rainfall and snow, saturated woodwork decomposes rapidly and should therefore be concealed in a temporary expedient, to be replaced by lead or concrete walls. There is little that can be done toward making a well-bearing structure safe from bombing, and wood floors add to the hazard. In new buildings designed specifically to withstand effects, the vulnerability of soft bearing structures practically precludes them in all but exceptional cases and at times the choice to one where the frame is constructed of steel or reinforced concrete. If members of the public and visitors are made aware, and if the principles of emergency are followed, it is possible to design a building in which extensive collapse is unlikely and a direct hit of a heavy bomb will not cause a major disaster. The problem of carrying over 4 miles electricity and gas lines public or private areas should be eliminated before they should be started. Auxiliary power plants should be in working condition and duplication of power, communication lines and other utilities is desirable. Wooden houses filled with sand, and bags, afford protection of machinery against fragments, but deposits of solid machinery, tools, dust and debris should

be stored in magazines against scattering. They should be dispersed, and should be away from the main buildings.



against direct hits of heavy bombs causing wide large groups are recommended. In shelter for more than 50 persons, or in dangerous areas, protection should be greater in proportion to the number of persons and relative danger. Protection should be continuous and sustained and maintained. The shelter should be built of materials which will permit one or more doors to be closed and open when one may be buried by debris. Gas should be exhausted by gas-tight steel doors in new shelters, by weather-stripping doors and plugging cracks and hatchways in improvised shelters, and heavy blankets should be hung across door openings. Some positive means of ventilation is desirable to avoid carbon dioxide and moisture. Pressure in a heavily gassed area requires a minimum of 15 cu. ft. of air per person for one hour's necessity. Filtration units are required to provide gas-free air and should deliver not less than 150 cu. ft. of air per person per hour. If electrically driven they should have provision for manual operation. Entrances should be at least ten feet above ground and more than one provided in case of damage or destruction. It may be an emergency consideration that two entrances should be provided. Stairways should be provided from the regular rooms, and auxiliary power from engine closets sets or fire stairs galleries. If a generator is used it should be separated from the main room and the exhaust piped out doors. A second source of water supply is desirable which may be a storage tank, or a pump system. Openings in a shelter should provide food and drinking containers, matches, peels and cloths, first aid kits (a oak box is a good case), telephones and surviving sets. Decommissioned motors should have clean clothing and storage bins.

Shelters within steel or concrete buildings should have ceilings strength rated and lateral protection. Strengthening should carry a load from 200-600 lbs per sq. ft. in masonry buildings, somewhat less in frame buildings. Foundation walls should be built so that a dead force weight of about 100 lbs per square foot is carried by the foundation, bearing water and snow areas, and ice. To save fuel or concrete framed buildings intermediate floors make good refuge, with less danger of being trapped. Also, check watch (From page 309)

THE ONLY *fledgling* RIDES IN THE SEAT UP FRONT



FAFNIR
Ball Bearings

THE MILITARY LINE—
MOST COMPLETE IN AMERICA



These sturdy, advanced trainees have proved that they can take a terrific beating in the hands of learning flyers, day in and day out. Stable, dependable controls are doubly important in these hard-working planes—they must function perfectly, certain rapid, sensitive and frictionless. That's why many aircraft builders specify Fafnir Ball Bearings for all controls! Fafnir provides the extra margin of safety and dependability that keeps

Wood-Plastic Plane

(Continued from page 26)

the wood-timers must be watched carefully.

Some parts which are being manufactured in wood-plastic construction are as follows: Tail-fin struts, panels, horizontal stabilizer surfaces, rudder, panels, navigation tables, door-travers, transport load cases, leading gear doors, side panels, luggage doors, etc., and lining panels of various types.

Several projects are under development, also, which cannot be publicly released.

Two new laminated spars are showing great promise in the small plane field. A special process of bonding up the bending strength of flying panels with particularly no increase in weight makes these spars especially desirable. In some cases these spars can be produced in laminated form for less than the usual cost of rough lumber for solid spars.

The Phoebe distributor and manager phones has been an especially interesting project. Among the specifications were the following: The door should withstand a stiff-legged jump from a sitting position at a six-inch height. Only 44 pounds weight, withstanding a 400 pound load on an arm equivalent to a woman's hand, withstand a load of 1000 pounds on a four-inch square in the center of the test panel, and withstand a reasonable period of continuous walking. Of course the floor weight was to be no greater than 10 pounds. Hand with the door closed, the door should withstand a load of 1000 pounds by the fact that when the door is fully open and static tests were passed, the panel was placed in the tools of the engineering department of a large aircraft company, and the number of people standing over it was counted. In an electric eye. After 10,000 walks the floor seemed to be at the same static as when just put down, and revisions in the door were made to building requirements removed all the test requirements. The floor used nearly 63 pounds per square foot in an airplane requiring several hundred square feet of flooring.

Another interesting development is Phoebe has been a series of tree take in which plastic materials have been converted to the wooden structures for flying airplanes. In the Phoebe project these became an integral part of the structure and the high bending strengths of the plastic used increase the strength of the attachment of metal fittings.

It is estimated that ten million pounds

of aluminum could be saved by substituting wood-plastic parts in present government contracts. Such substitution would presuppose the availability of sufficient engineering talent and proper factory space and equipment. For the present, only the simpler items, preferably those using long panels, are amenable to such conversion.

In conclusion, it is felt that Wood-plastic construction can be a great aid to states of the independent design of light aircraft. In some cases it can even prove to be more economical to build wood-plastic parts than metal parts, but the difference is small in proportion to what is gained. Wood-plastic construction is showing many advantages for certain applications and finding a permanent place in itself on its merits.

The design group of wood-plastic products has been organized by the author specifically as a group dedicated to these manufacturing problems. It should be encouraged by the government as an important design resource and an important contribution to the refinement of airplane design.

Fleetwings

(Continued from page 27)

2. Answer to that was a small shelf (Fig. 7) on which is mounted a dipstick which the end of the spoiler fits. The dipstick is suspended on a spring, which allows adequate flexibility, and the entire unit is set on a table. This one unit is released for production elsewhere in the factory and the spoiler

Mitchell Field

(Continued from page 26)

during a severe thunder, lightning bolts for oilers, nosecones, and enclosed nose cone retaining grommets, a grommet, a 130-lb. hook, and a grommet for the landing skid support system. The last part, which has been held up until the delivery of belays, requires reduction rate of 24 percent to conform to New York City's 47 percent standard rate at one-half of one percent.

For ease in handling a payout ring is broken into two main sections.

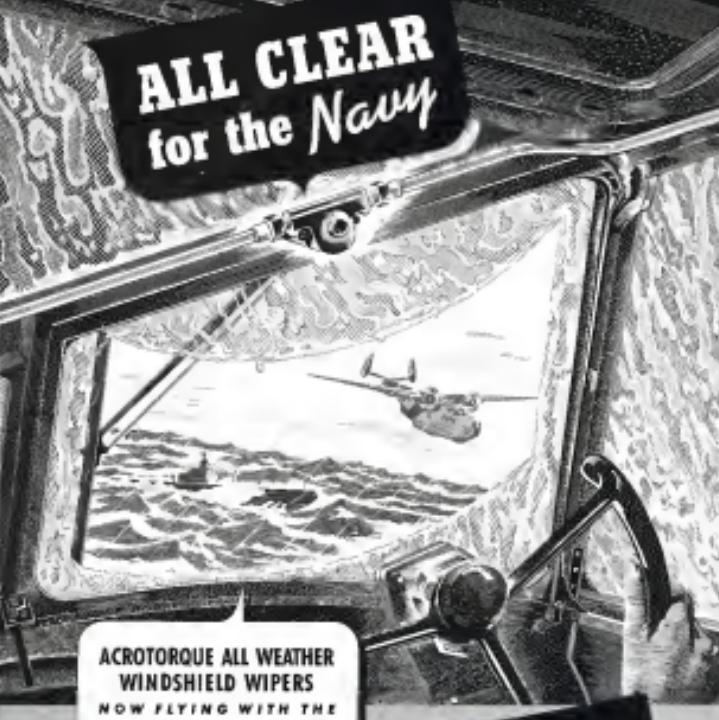
The group is commanded by a Major General each group is divided into three wings, commanded by colonels, each wing having three squadrons, commanded by a major, and each squadron has eight companies commanded by lieutenants.

Each flying officer (second lieuten-

ant) has under his direct supervision a group of five men assigned to his plane including a cookhouse, an armorer, a metal worker, a radio repairman, and a servicer. After each flight, the pilot flies out a report form noting any irregularities in performance or suggestions for improvement of his 1800 horsepower turbocharged ship. General crew work from this report.

In view of course Mitchell's four 3000-foot concrete runways and elaborate anti-snow facilities are shown here by the photos which are scattered to obtain of winter-maintained availability, striking instances of present military objectives which might be sought by an enemy.

ALL CLEAR for the Navy



ACROTORQUE ALL WEATHER
WINDSHIELD WIPERS
NOW FLYING WITH THE
Naval Patrol

ACROTORQUE
THE ACROTORQUE COMPANY
6145 JACKMANN AV., CLEVELAND, OHIO • 44116 MICHIGAN AV., LOS ANGELES, CALIFORNIA

X-Ray Inspection

(Continued from page 21)

not be relegated to engine and airframe diagnosis is ever-lasting. This may well argue against the advantages of early diagnosis, but such variables are overcome, by choice "green world", through choice of patient personnel capable of exercising sound discretion in expediting conclusions.

Assuming various materials that are inspected by x-ray are within detectable metal objects, which, hydride splinters, galvanic pressure vessels, bars, forgings, rolled metals, and castings of all sizes and character. The examination of these materials is generally confined to the determination of gross defect and to the presence of intergranular corrosion, the magnitude, depth, and the angular disposition of such anomalies. Places such as grain boundaries, stress risers, porosity, and inclusion as well as interstructural irregularities such as metal segregation, and intermetallic precipitates of solid solutions, all constituting the detection of the material. Yet the material may appear perfectly sound from external examinations.

X-rays, however, are not a panacea to the detection of the manufacturing string symptoms and cause for the "catalog" of low metallic residual through more radiographic investigations. Gross defect is one of the determining factors in the failure of many metal structures and which may readily be detected by a radiographic examination. These gross defects, however, have been revealed radiographically as perfectly sound base failed in service. Corrosion may be detected in the cause resulting in one or more of the physical signs such as internal stress, intergranular embrittlement, lattice phase distortion, intermetallic corrosion, or atmospheric precipitation, and many others, any of which could be directly detected by x-ray, including the presence of hydrides. However, may also be had a qualitative analysis of such defects by photomicrographic procedure, or to the quantitative estimation by x-ray diffraction patterns. These may further be supplemented by micrographographic evidence of a status of the metal under consideration, and where necessary, confirmation may be made by thermal testing before an official report is presented.

To elucidate the discussion, Fig. 1 represents a photomicrograph of Dogger-reef after showing large hydride and intergranular embrittlement as defined by widely separated grain boundaries.

Such a condition is characteristic of typical intergranular corrosion. The specimen at a second view of a portion of a hydraulic tubing which has failed in service. No cohesive resistance could be detected by a radiographic examination, leaving definite weight to the importance of micrography, radiography, and photomicrography information.

Out of the recent cases brought to the attention of the research department of the Laboratories is a Magnesium alloy casting, Fig. 2, consisting of 6% Aluminum, 9% Zinc, 0.2% Magnesium, and Magnesium for the balance. In the past, many of the same writings had been reported, but the point of importance relative to this particular casting was that a severe streak of intermetallics was found in the center of the casting. It was located in the middle of the casting, and the production of the radiograph shows in Fig. 2 this is represented by a streak of white area extending radially from the axis along the rib and pointed out by the arrow marked by A. From my opinion than this might be expected to be Magnesium-Zinc polycrystalline precipitations of the Mg₂Zn component. But photomicrographic findings, Fig. 3, supplemented by a quantitative analysis of the area concerned with some intermetallics, indicated a conclusive evidence that the specimen under consideration was of Aluminum rich Magnesium in homogeneous solid solution.

It has been found by investigation that the solubility of Aluminum or Magnesium ranges from 3 to 7% by weight at room temperature, which amount is almost second to the present alloy under discussion. The solubility of Zinc in Magnesium is placed at 1.9% at maximum.

The percentage of Aluminum in the test specimen was found to be 9.81, which figure 3.67% above that normal to the Magnesium alloy, mass of 200, or Magnesium in the test area evidently having been eliminated by a quenching analysis. The precipitation is again confirmed by observed data that the casting of Aluminum due to the presence by Magnesium is an inverse function of Magnesium content as the alloy.

X-ray has further shown that during the changing of a thick metal section of a metal to its solid state, the granular structure of the particle has a tendency to grow large. Such a condition may also give rise to undesirable segregation of generally extensive nature in the portion of the casting solidifying most slowly. With this latter condition in mind, and prior to the completion of the calculation of the cooling, adequate temperature conditions exist in the entire area over the form-



Florida's sunshine is doing its part for national defense. Winter vacations will pay defense dividends in better health and work for thousands of Americans.

But there's another kind of news from Florida, too, this year—news of production, increasing as fast as more machinery can

be installed and qualified men forced to operate it, at Intercontinent Aircraft's new Miami plant.

Intercontinent, milspat in South Florida's progress to its future as the air center of the hemisphere, is doing a good job for democracy today.

WE ARE ALL AMERICAN
AN ANNOUNCEMENT OF 1962
JANUARY 5-10-11

M I A M I F L O R I D A

Lockheed Dies (Continued from page 11)

blinking 1000 pieces on a Kerkote die is very good, less than that at the start of the run. This results from the tendency of the Kerkote die to flow slightly under impact or the shearing operation. Such flow as occurs is turned the shearing edge of the die rather than away from it, so that the surface stress wave front is not affected by the die's downward movement in use. Of course, the die must last. Tools and the die-making fee will eventually become sufficiently decreased so that it will be dictated. But this does not occur until considerably more than a thousand operations in most cases, and this is sufficient protection for the majority of aircraft parts.

We have already adopted the Kerkote process dies after a wide range of parts have been made. Masking operations, though they are not yet fully developed, have been formed and blued three 24 SG and 24 ST up to 125 pounds, but we have immediately formed stan-

less steel parts on Kerkote dies.

Production of Kerkote dies is very simple and logical; a procedure well established through the production of such dies for deep drawing work. Kerkote die is patterned along the lines of such chemicals, copper and magnesium. It has about six or seven times the impact strength of steel plus a much greater abrasion strength. Production of Kerkote dies is approximately the same methods as those used for steel. The pattern is made of wood or plastic and a sand mold is made from the pattern. The metal is poured into the mold and any little machining required before the casting proceeds. The deep drawing work is finally done in Kerkote die, but the punch is steel.

On masking dies machining is mostly removed as a light air scroll. The tool is the die to produce sharp edges

Usually the die can be reused, following a production run, by taking another light cut across the face of both dies.



Showing masked and painted part being held with snap after blanking and parting operation. Rubber stopper plates are used for stopping snap and parts.

Beryllium Alloys in Aviation

(Continued from page 11)

18 percent lighter than materials specified. Assuming that approximately all percent of the modern airplane frame is designed by engineers, "Beryl" having double the modulus it is possible to cut the gross weight of a material at the same time as the difference in modulus of "Beryl" 35° would be the cube root of 2. Dual gauge would be 126 percent of "Beryl" gauge. The net weight savings would be 18 percent by reduced specific gravity keeping the class gauge. Dividing 126 pounds by 126, the "Beryl" parts would weigh approximately 81 percent of the Dual parts, or a net weight savings of 30 percent which is considerable.

In a two-stage weight lifting plan the net increase in the axial load could be shown in Fig. VI.

Economic Factors

With respect to the economic factors the cost of elemental beryllium is \$9 lb./lb. per production will be \$11.00 per lb. All of the excess high-grade beryl was shown that required for beryllium as an alloying element with copper and nickel were made new elemental beryllium, a ton a day of Beryllium could be made available at \$9.50 per lb. The trade factor that the average production cost of elemental beryllium is \$12.00 per lb. and since \$1000 lb. cost at a rate of \$18 per lb. of metal load against \$20 per lb. of metal load for Dual aircraft at \$125,000 with metal load of \$6000 is



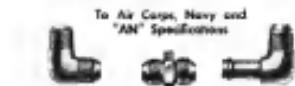
Safeguarding the Lifeblood of Aircraft

* Gas and oil lines—the circulatory system of a plane—are small but important factors in air supremacy for the Nation.

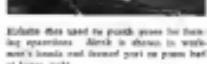
As a manufacturer of precision parts Dole has for many years produced to the closest specifications. The tolerances of aviation were neither new nor an obstacle. Already the major airplane companies served, have confirmed the ability and accuracy shown in Dole Products.

THE DOLE VALVE COMPANY

1938-1941 Compt Avenue, Chicago, Illinois
ALBANY - DETROIT - LOS ANGELES



DOLE FITTINGS ★ ★ ★
★ ★ ★ and VALVES
For Aircraft Pipes & Tubes



Sheet metal parts being formed by Kerkote dies for blanking and bending. Metal sample submitted July by which date no heat is held in heat and none is given.

Published monthly by the American Society of Aviation Engineers, Inc., 1938-1941 Compt Avenue, Chicago, Illinois. Subscriptions \$1.00 per year. Single copies 10¢. Second-class postage paid at Chicago, Illinois, and at additional mailing offices.

AVIATION'S COMMERCIAL NO. 1
AMERICA AT WAR
(Continued from page 33)

trace among the hellfighters. In Asia the Japanese display no such courtesy. They have long forced PAF's Ghora National Airways to fly in dark at night. Remember what they did to the DC-3 on the ground, which flew over later with a DC-3 wing on one side!

Other evidence that Europe is finally safe for transports is seen in the expressed willingness of American Export Airlines, which has bid for a route to Ireland, to fly into the country now.

Individuals, however, presented that the Navy would take the three Sikorsky S-40s waiting completion for American Export. One import to the Administration fearing that the S-40s even to Pan American Airways but such information is probably untrue.

Rigorous of course airline operations, the mail and express goods and official flights go through Roads and Waterways. Airports at places, and still airfields in places in overseas operation, a new well-established. To shield negotiations, Navy could absorb Pan American and Panair, which they should do.

To meet the added demands of fighting the Asian warheads, as well as compelling others to fight, COTM immediately began to expand production, including seaplanes. COTM Director William Randolph said the heavy bomber contract objective is raised from 500 a month to 3000 a month by late next year. All plants were asked to go on a 7-day week. No time was set because the throttle is wide open overseas. A White House call for an appropriation of half a billion dollars was put in paragraph, as it was written, for the Navy at once. You can reasonably look for a special program of Navy patrol bombers. There is no use of nothing concentrated because the carrier capacity is at the mounting figure now.

On October 1, 1943, the Navy or one had a total of 4735 planes of all kinds. This is probably about equal to, or greater than, the entire Japanese air and navy air power. Deliveries to the U.S. Navy in the first four months of 1943 were 297, 381, 281, 273. These figures are about equal to the total monthly aircraft production of Japan. Of the total 986 Navy planes for those first four months, 660 were carrier planes, and the rest were bombers. Navy's objective is 15,000 planes but that no longer matters. Fighting now is winning and we must continue.

Now, however, the Hornet, per commandant, which brings the U.S. total to eight. Eleven more are in the Navy program for completion in 1944, although that may be speeded up. If the French later November is concerned, at \$3,000 planes would equal three ordnance carriers. Some interesting shapes we being built for conversion and many of them will carry interlopers for their own lookout jobs. Possibly some large bases at Allied countries will be taken over and converted to carriers.

For those in few years now, disastrous when people have speculated so much on what would happen when war came, that those who were wrong for that to chew on. Unquestionably, those who were right, those present in the making of the nation's victory, would be honored, deserved them to take notice and do their job. So far as anyone could see to the first weeks of hostilities, the airlines are a highly necessary gas in the war machine. And they are and have been bearing it so well lately that no one could think of any good reason for being taken over by Washington.

The Army did banish its transport planes from the air lanes, to perform an "administrative mission" last fall if it would return the planes in a few days. The nation was

not pleased, but "administrative" means it was not tested. As we have said before, the airlines will be subject to regulation of their equipment throughout the war. How much of this will be done as one can goes.

Being granted war no surprise for the pilots there. Only, they are not really granted. Any pilot who can prove his citizenship and loyalty can get certified and get back to the air.

COTM has just got itself organized just in time, with one admirable work on the part of the Office of Civilian Defense, the Air Forces, National Aeronautic Association, and others. We Dissatisfied has assigned Maj. Gen. John F. Clegg to the Office of Civilian Defense. Director Donford LaGardia has appointed him National Commander of the Civil Air Patrol. Rural Lands, World War II, is another. And to LaGardia. Each state will be organized in a Wing of CAP with a Wing Commander and Executive Officer. Each state will be subdivided into groups, determined by the number of available planes and pilot in the state.

What do you do? If you are a pilot and want to be assigned to CAP, get an application blank from a CAA office, a state aviation officer or an airport director, now or soon. Fill a fingerprint card with it, and send a 14 in by 14 in photo. They don't telephone Washington, and don't write to the government. And don't come to Washington; there are no rooms to be had. If you can't stand waiting, write to the National Aeronautic Association, Wilford Hotel Washington, D. C.

CAP will begin for the deadline approximately 94,000 licensed pilots, 95,000 student pilots who will be licensed by Spring, and about 100,000 ground personnel, all male, mostly volunteers. 120,000 civil seaplanes, and 2000 airports on which there are no military or rehabilitation or open ports.

At the writing these had been some duration about Army taking over the CAA Civil Pilot Training Program, but no definite word had been received.

The question whether Russia would permit the use of its air bases for bombing Japan was once critical at this point to press. Russia had declared war on Germany with the United States, and our declared war, declining to negotiate an additional front, put us in Eastern Europe. But the Russian idea that the Soviets would not let that sort of bases would be desired. The United States probably wants bases on the Peninsula of Kamchatka, too.

It seemed more probable each day that unoccupied China's army, rising with own strength, would fight its way to reoccupation of most of the Chinese seaports, which then could be used by America at landing and naval bases.

Delivery of planes, especially aircraft, moved now from something for smaller to link about to a regular. Though some of them around most planes, and anti-aircraft gun were set up. Operations on the West Coast struggled with black out problems.

The President asked for an \$80,000,000 Naval air base at Floyd Bennett Field, Brooklyn, New York.

The Civil Aeronautics Board announced a drastic cutback of hearings on pending applications for route certificates.

Civil Aeronautics Administrator said that seven routes for training export and Army traffic control operators are being established, as CAA proposes to take over additional import control towers.

New Departure

. . . all out for defense

Concentrating its great manufacturing facilities on the production of ball bearings to established American standard metric dimensions and tolerances, for quickest possible delivery.

* * *

A speed bearing requires extra tooling and different machine set-ups—might well delay delivery of many standard bearings. Government and industry are cooperating in speeding defense with standard bearings.



New Departure
THE FORGED STEEL BEARING

NOTHING ROLLS LIKE A BALL



NEW DEPARTURE • DIVISION OF GENERAL MILLS • BRISTOL, CONNECTICUT

CRESCE

Aviation CABLE

Crescent offers a complete line of wire and cable designed to meet the aircraft industry's most exacting requirements . . . built to the same standards of precision and quality which made Crescent the biggest independent manufacturer of replacement wiring for the automotive industry.

Lighting Cable

Two-Conductor Cable

Ignition Cable

Starter Cable

Available in both shielded and unshielded construction to meet Army and Navy specifications.

★ ★ ★ ★ ★
Your inquiry concerning aircraft cable for any type of circuit will receive prompt attention.

The Crescent Company
Providence Rhode Island

cable. Its compact 2-cylinder opposed engine, turning up 4,000 rpm., is capable of delivering 13 hp at sea level. Its generator can supply 2 kilowatts maximum, and its high (7) load-factor for 5-minute periods.

The Lowrance unit is remarkably quiet in operation. It is mounted in a case which has been built to meet all military shock and vibration test requirements. The main pacemakers of the unit can best be gauged by the fact that it is installed under a seat at the right operator's station on the flight deck.

A stored by power supply is provided by two 3-kilowatt generators mounted in the reduced pressure cabin. In addition, the system is supported by two 24-cell storage batteries, with a regulation of better than two percent. Any one of these supply sources can be utilized to power the electrical and communications equipment of the ship.

Numerically are some of the overall statistics. There are over four miles of wiring in the electrical and communication systems of each ship. There are no less than 88 lighting fixtures and outlet plates, and 39 electric motors.

All circuits are protected by thermal circuit breakers instead of fuses. Electrical motors have regressed stay-magnetized and hydraulically reversed. The ship also has aural direction. A J-16 receiver covers the Midwest for the communications system. Two separate electric fuel pumps are provided for priming the engines. The radio logic for the automatic direction-finder also are electrically operated.

The galley equipment is all electrically operated, with the exception of the refrigerator, which utilizes dry ice. There are two hot-plates, an electric oven and deep-freezer for meat and coffee makers.

Communication System

There are 20 separate radio units in the communication system. There are three low 100-watt transmitters, each capable of operating on eight separate channels. There are three 100-watt receivers, each capable of receiving both radio-telegraph and radio-telephone operation. Also, the ship can be operated simultaneously and independently of another, working from 200 kw to 20,000 kw.

There are three receiving units, two of them normal communications receivers covering from 150 kw to 20,000 kw. These sets also can be used either for radio-telegraph or radio-telephone operation. A short set is coupled with the automatic direction finder.

The YS-44 is equipped with twin direction finders, one omnidirectional and one of the searchlight type. Both of them can be used by the pilot, radarman or navigator. As a matter of fact,

radar controls and indicators are provided for all the receivers and direction finders. The antenna system comprises two transmitting and two rotating antennas, fixed fore and aft.

An interphone system consists with eight areas, stations. Over this system the pilot can talk to any one of his crew. The interphone connects with the pilot, copilot, radio operator, logic engineer, navigator, weather compartment, galley, entrance compartment and tail. Radio compartment has a number of conveniently placed indicators used for signaling the steward. He signal board in the galley indicates the position of the roll and holds until arrived.

The communications system was developed by American Bosch. After several years' practical study with the experimental operation of the PBY.

Heating and Ventilating System

Considerable ingenuity entered into the design and installation of the ship's exhaust heating and ventilating system. Heat is supplied by two turbines mounted around the exhaust ducts in the cooling sheet of the two reduced engines. Each heater is capable of delivering 90,000 BTU per hour, which is equivalent to the heating losses expected in normal flight. The total heat available is 220,000 BTU. At cold temperatures of 20 degrees with -20 degrees temperature outside and both engines running at normal speed.

The temperature is maintained by a thermostat in the forward passenger compartment which automatically regulates a damper proportioning the amount of cool air entering a mixing chamber. To avoid too sudden changes in temperature, the damper is actuated by a small electric motor geared down 2000 to 1000 rpm.

Shorts of the system are fabricated of thin sheets of beta wool treated with fire-proofing solution and reinforced with an outer covering of Fiberglas. In addition to the water air intakes placed under the windows and ports of the compartments, numerous fresh air intakes are provided which can be opened by the passengers.

Double doors in the hull further minimize gas leakage from the exhaust and the heating system is provided. Pressure in the latter envelope is maintained at a higher level than in the exhaust ratio, so that any leakage would be from the latter into the exhaust rather than the reverse. As an added safeguard, a CO detector is installed.

This is a shutoff valve which kicks up immediately when any trace of monoxide is present. A thermostatic automatically shuts off the hot air shutter and operates visible and audible alarms on the flight deck.



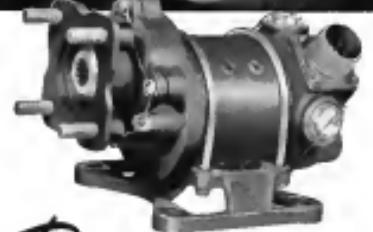
JUST AS bitter experience has taught man to fear the deadly colossi, so will it warn the enemies of America to fear the even more menacing Airacobras. With engine moved to the rear and cannon and machine guns mounted in the nose, the Airacobras is recognized as one of the world's most deadly single-engine pursuit ships.

We of Almetniss Industries are proud that we contribute to the structural strength and efficiency of the mighty Airacobras by casting of Perustal aluminum alloy, the filler-body for the turnover bulkhead, as well as other essential parts.

Whatever your needs may be for aluminum or magnesium alloy casting of the permanent mold or sand types — our expanded facilities are at your service as promptly and completely as our part in the National Defense Program permits.

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio
DETROIT, MI New Center Blvd. — LOS ANGELES, CALIF. San Pedro St. — CHICAGO, ILL 1515 Michigan Ave.

PERMITE *Aluminum
AND
Magnesium* **CASTINGS**



Power FOR THE PUMPS THAT PROTECT THE FLOW OF FUEL

Large numbers of Delco explosion-resistant fuel pump motors, conforming to latest military aircraft requirements, are being built to equip the bombers and fighters of America's expanding air production. Lightweight and compact, these high-speed motors provide exceptional dependability in starting, transfer and booster duty.

To its assignment as a supplier to the aircraft industry, Delco Products brings a wealth of experience in applying metals to close limits and in designing units to meet particular applications. The Delco Products Engineering Department is qualified to cooperate with manufacturers in the development of electric motors for aircraft use.



DELCO MOTORS
Division of General Motors Corporation

Chicago & Southern *(Continued from page 203)*

planes, so that they terminate at the base station at the proper time for their regular periodic aircraft and overhauls. Prior to arrival of that airplane at the base station, shop foremen are advised as to what service and overhaul time will be required.

Spares at intermediate and end stations, 1 spare landing wheel complete sets are, axle and brake assembly, 1 tail wheel and tire assembly and landing gear struts, etc. Other items required for changing of tire and wheel assemblies is carried in all enroute stations for quickly servicing an airplane in case of a flat tire.

Maintenance other, service equipment and spares are also carried at maintaining stations far out of routine service and emergency. These spares are determined by careful analysis of possible troubles and by service experience.

In keeping with the company's policy for expansion in the expansion of the line's services into new territory, operating from Memphis, the service flies in Douglas Cessna 141A miles north to Chicago, 387 miles south to New Orleans, and 284 miles southwest to Beaumont. The company has no file application for Certificate of Public Convenience and Necessity for new routes between Memphis and Detroit by way of Paducah, Evansville, Anderson-Marietta, and the Ohio River to Toledo. It has filed application for new route between St. Louis and Detroit by way of Terre Haute, Fort Wayne, and Toledo or by way of Terre Haute, Indianapolis, Anderson-Marietta, Fort Wayne, and Toledo.

To expand its southern service, the company has filed application for alternate new routes between New Orleans, Shreveport, Tex. Woods, Oneonta and private service between New Orleans and Shreveport by way of Baton Rouge and Alexandria. Another route will serve New Orleans and Port Wessel by way of Baton Rouge, Alexandria, Shreveport and Dallas. The third alternative is between New Orleans and Port Wessel by way of Dallas.

Another application of the company seeks to establish a new route between Memphis and Plano/Dallas for service to Paducah, Evansville, and Cincinnati.

Chicago Section has had a steady application for a new and modern office building and operations base, increased route mileage, expanding passenger facilities, and a reasonable expectation of higher mail revenue. Its outlook for the future is definitely encouraging.

NERVE FATIGUE PROTECTION



Courtesy Royal Air Force

With Kapok Unisorb® Noise Reduction Felt

BRITISH bomber crews have it.

*
Commercial passengers demand it.

*
Acroplane manufacturers problems on this vital point are solved with Kapok Unisorb Noise Reduction Felt.

*
Kapok Unisorb meets British and U. S. Standards.

See U. S. Pat. Off.

SEND YOUR ORDERS AND INQUIRIES TO APPLIED DIVISION

THE FELTERS COMPANY, INCORPORATED

210-S SOUTH STREET

BOSTON, MASSACHUSETTS

OFFICES: New York, Philadelphia, Chicago, Detroit

DISTRIBUTORSHIP: Dallas, Los Angeles, Pasadena, El Dorado, Ft. Lauderdale

3000-J Avenue One, New York • Melrose, Massachusetts • Jackson, Michigan

FELTERS FELT FUNCTIONS

Washington Airport

(Continued from page 14)

marked on top of the normal tower mast. These are supplied from the boundary circuit through series resistors to multiple transistors. Each landing field floodlight has a twin strobe-light mounted on top of the tower. These are also supplied by the boundary circuit through series to multiple transistors so that a master that can set the two strobe-light units on each floodlight to flash alternately. Boundary circuit is fed from alternate boundary current sources. The lighting described here is standard and has been used for several years in regulation which have been effective for a number of years.

It will not be necessary for the control tower operator to radio landing directions instructions to the approaching plane. After "landing clearance" has been given, a green arrow at the end of the runway to be used will be lighted. This will also be visible in the distance to indicate the landing direction and shows that the runway is clear for landing.

If an emergency arises so that the runway cannot be used and the obstruction is cleared, red lights will be turned on at each end of the "blended" runway simultaneously. These red crosses flash 40 times a minute to attract immediate attention. No safety is presented on the runway when they are set on and when lit, they signal any aircraft landing that this type of landing direction signaling will never before have incorporated in any lighting plan.

Where there is a shortage of space, two or these arrows and crosses are formed by transversely fixed marker lights, and are set in the centerline runway. Each of these consists of 36 flood marker lights having asymmetric distribution. It gives one long horizontal arrow pointing in the direction the runway crosses which will be explained later. The red and the green are unidirectional multiple currents so that they can be turned on separately.

The wider pointer nearest the runway to be used is set west. This gives the pilot a check on the landing direction indicated shown by the lighted green arrow and lets him know whether the wind is blowing steadily or in gusts. Pilots pay close attention to winds from the north because, especially when approaching from the east, the angle of attack due to the ground and descent rate which vary very considerably in direction and velocity from the wind a few hundred feet up. Therefore,

adoption of strobe generators for airports is considered a logical aid in pilots. The Boston and Oakland (Calif.) airports are the only airports to use this in this manner prior to its use at the Washington National Airport.

With the present time, vapor lights, the strobe lights, and center lights in the runway to be used. Only those floodlights at the approach end of the runway will be lighted so that the pilot looks over them with the lights to the rear. Two landing field floodlights are used at both ends of each runway. These floodlights are the 25-inch down type and utilize a Holograph spread lens to fix the light out horizontally. The run-

way lights and body traffic lights are similar to those used on many airports during the last five years so that they project only 3 inches above the ground and are spaced approximately 280 feet apart. However, the standards covering the runway lights have been revised so that the lights have changed within the last year. The specifications now call for an automatic deactivation so that the highest candle power are projected up and above the runway, with a lower candlepower source and away from the runway. When approaching the field and in line with the runway this enables the pilot to see the lights from a considerable distance, and yet the heat alongside the plane will not blind him when the lights are on the runway.

Where the runway is intersected and where a former parallel runway is planned, the constant lights which normally fall in their intersection are omitted. All runway light units are cast into a concrete block set on the edge of the runway paving, and are supplied through a conduit from a headbox at the side of the runway. The constant lights for each runway set on a separate 60-ampere series current and only the lights for one runway will be turned on at a time. Thus, the maximum current which may supply these circuits need be only large enough to handle the lights on the most heavily laden current.

A system of brightness control adapts the runway lights to changes in weather conditions. The range of visibility demanded is such that a road designed for slow weather would not be visible in heavy fog. Conversely, sufficient light for low visibility would blind the pilot in clear weather. The normal lower limit of visibility requires the atmospheric transparency and also the brightness of the constant lights to set in. This is accomplished by using an auto-transistor. In the regulator resistance circuit with three taps to give intermediate brightness is possible and increase the visibility to a maximum level.

Each floodlight uses a 3000 watt lamp operated at 32 volts.

These lamps have more concentrated filament than corresponding 110 volt lamps, and the smaller filament allows much closer control of the light in the optical system of the floodlight. The electrical supply for the floodlights is run at 3000 volts from a main switch in the basement of the terminal building in a single or east runway end. Here it is stepped down 32 volts and distributed to the two floodlights. A second distribution board forms in these yards step the voltage down to 110, which serves the inside lights, handrail cross-ties and arrows,

As Dependable a Work-and-Time-Saver as the famous RIGID Wrench



This **RIGID** No. 65B Threads 4 Sizes of Pipe With 1 Set of Chasers—Sets to size in 10 Seconds!



One of a Complete Line of **RIGID** Pipe Tools, No. 650-C

Tools Not Priced, \$17.00

YOU enjoy the same dependable service from this die stock as millions of users get down the **RIGID** Wrench—PLUS extraordinary saving of time and effort. A 10-second adjustment sets it to thread 1", 1 1/8", 1 1/4" or 2" pipe—all set of chasers that stay true, no extra sets to lose or waste time. Feed-proof workholders sets instantly. It cuts clean perfect threads ready— you can take it with your little fingers. Long-lasting high speed steel chaser dies, powerful all-steel and malleable alloy construction. Try it at your Supply House.

THE RIGID TOOL CO., ELYRIA, OHIO

RIGID

Pipe Wrenches, Cutters, Threaders, Vises

Work-Saver Tools for America's Big Job in 1942

RIGID saves you all pipe wrench housing repair expense



If the Rigid ever breaks or shorts out and you have to buy a new one, save the money. Few of others are made like ours. Adjusting tool is open housing spine adjustable all ways, 5° to 10°. Millions made. Buy from your Supply House.



Does not reduce defense requirements in being fast
with this durable, corrosion-resistant Stainless Tubing.

Vast parts are being fabricated from stainless defense plates we furnish—emergency repairs and replacements in mining equipment are being made with it to keep plants operating.

Carpenter Welded Stainless Tubing meets U. S. Army and Navy specifications—and is truly hemispherically sound, semiautomatically welded by the same atomic hydrogen methods (no weld is added)—the weld when tested shows the same analysis as the parent metal.

For further information on this Stainless Tubing—the corrosion and heat requirements it is meeting—the message it is offering for defense—and data on sizes, gauges and sections, send for a copy of our 16-page Welded Stainless Tubing Data Book. It contains much information you will need when planning the use of this tubing.



THE CARPENTER STEEL CO.
WELDED STAINLESS TUBING
HENRICKSON, N. J.

Carpenter
WELDED
STAINLESS TUBING

lights at the far end. When such a condition exists, the pilot knows that he has only 1200 feet of runway left when he reaches the yellow lights, and to that distance he must bring the plane to a stop or stay in the air, credits through 360 degrees and try a second landing.

In order to have the last 1200 feet from either direction appear yellow, the center lights in these sections are half-clear, half-yellow "split Blue" color-screens. The clear side is always angled toward the nearest runway end. The units between these two 1200-foot sections show clear through 360 degrees.

As the plane slows to landing speed and is ready to approach the final approach, the center two lights are brightened so that the runway, occupied by the plane, is the attacking target. Keeping to the right of these lights, the pilot is able to follow them in perfectly to the terminal building. These run lights are installed on one side only of the taxi strips and sections of runways used for taxi purposes. Each straight section of lights is on a single multiple circuit, since various controllers are used to handle the signals required to lead in the planes from various points of the field. The same controllers are identical to the constant facility, except that blue color screens are used. Here, again, the color filters serve to project the lights counter-clockwise up and down the two strips. Sparsely spaced lights are 200 feet apart and they are installed in sequence at the edges of strips or runways as are the various lights.

Wherever a turn occurs in a runway, traffic lights facing the turn strip indicate that the crossing is clear if green shows, or the plane must stop if the red light is lit. Both traffic lights are separately controlled by the control tower operator. When traffic lights on the part of these lights will be made to avoid confusion between runways and thus using the message for take-offs. These may also be used to control lights entering or leaving a runway area. A 270 degree vertical screen is mounted inside the lens, and the light is projected toward the sky angle so that they will be visible only to the planes for which the signal is intended.

As a plane is turning out for take-off, it will again be guided to the end of the runway by the blue track lights. These track traffic lights before the terminal building show that the crossings are clear or necessary stopped. Track traffic lights are deemed to their function as directional "stoplights."

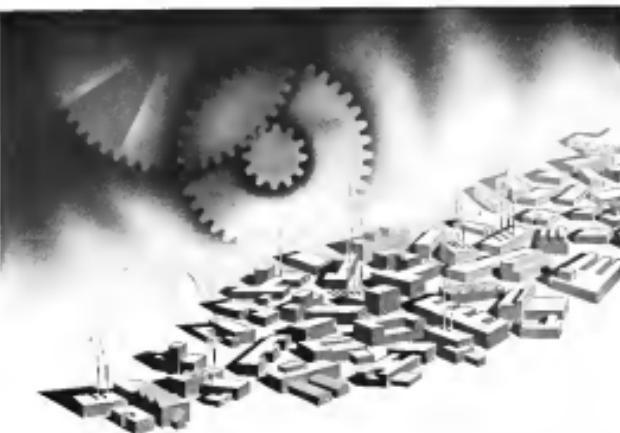
The take-off traffic signals are not used. Each bank consists of two green

and one red projector. The red, and one of the green projectors are very similar to a standard highway traffic signal in construction. Each unit has a 100-watt, 100-watt traffic signal lamp, and one green uses employ less heating, a wide angle of operation. These projectors are spaced less contractingly to give both close and remote operation. That is, at the end of the runway area the pilot is given a heads up with a wide angle of spread matching up well for site greater projector. At the other end of the runway, it gives a high candle-power beam with a narrow spread as does the other green projector. These are used to signal to place at the far end of the runway.

Thus, when the plane takes off on the runway, the traffic signal at the rear end of the runway will show red and both the green projectors will be off. As soon as the green signal shows from both the wide beam projector at the near end and the narrow beam green at the other end, the take-off is "clear," and the plane may taxi out on the runway and depart. Using this system, it is not necessary for the control tower operator to communicate with the pilot by radio to advise him of the green and projectors at the far end and in another the use of the "Hold-up" by which the operator in the tower signals to planes to take-off. At the Washington National Airport these "Hold-ups" are mounted on the floodlight standards so that they are always aimed directly at the plane toward which the signal is to be transmitted.

The control panel for all of these lighting systems is by the three-position switch located on the deck. It places control of all the field circuit at the finger-tips of the operator and makes him responsible for movements on the field. The system can be expanded to supervisory control in an industrial plant or central station. However, in addition to providing circuit control, the panel supplies other operations for the use of projectors to do the lighting required for landing or take-off, which are set up in advance, and the correct circuits will be energized by the use of the "Hold-up" or "Take-off" switch. Without such a system, the control tower operator, who needs time to observe and control the planes, would be lost in a maze of switches.

The Civil Aviation Administration planned the layout for the airport and, in so doing, kept three objectives in mind: (1) to provide all possible lighting facilities for safety; (2) to plan for future expansion by having available funds which would move planes quickly; and (3) to establish new standards for lighting which would place airport lighting equipment within the financial reach of airport budgets.



240 MAN-YEARS

OF SUBCONTRACTING EACH MONTH

To keep on schedule with the growing needs of the military services, Sperry has doubled and redoubled its production many times over. Yet even with advance planning, enlarged floor space, and vastly increased man power and machine power, the present production rate could never have been achieved without the willing assistance of subcontractors.

Since 1957 the number has gradually increased until now 145 subcontractors are putting their shoulders to the wheel. Their contribution already aggregates 600,000 hours or 240 man-years each month.

SPERRY GYROSCOPE COMPANY, INC.

Brooklyn, New York

Country Club Airport

(Continued from page 347)

front long and without feet steps, except where the older projects out from the airport nose eight feet. The entire structure is white and of modern design, with a flat roof. The central tower rises above the main part of the building and is topped with a dignified red-roofed cupola which fits effectively with the design of the building.

Concentric ditches and paths were set out in landscaping the road side of the holding and approach. Started about three hundred feet from the highway which runs on the east side of the field, the holding is approached by a gravel driveway which is divided for entrance and exit by a strip of grass which will later be planted with flowers and shrubbery. A gravel circle allows one to swing by the front door. A concrete walk connects to the main door, and runs around either side of the house to the field itself. Setting off the exterior is a small flag pole directly over the main entrance.

The building itself has four main parts, the lounge, the bed and office, the bar, lunch room, and the control center. Below the hall itself is a small cellar. Entering the lounge door, one immediately comes into the hall which is furnished with tables and chairs last day. At the opposite (west) end of the hall is the office which is partitioned from the rest of the room merely by a long and attractive display counter enclosing the complete display of the room except for a small entry way to the office proper.

Data is modern design with vertical and horizontal fluorescent lighting, the office is very spacious, light and airy, and colors are at the rear of the building, and it is pleasant shade of blue with emerald and blue shades on the floor. In the center of the room is an antique compass feature which is the location. Just inside of the doorway is a small staircase leading to the basement with a starting garage. The door to the garage is large and has an automatic door way. The garage and entry walk up the stairs. The office space, although not large, is an excellent example of efficiency in conducting airport operations. As mentioned before this part of the building puts one seconded the airport some night, but more than the rest of the hours. Large windows overlooking the field give the officer a clear view of the field. The office is built about north, south and east. In the space between the stone corner and rear wall sits a fine monolithic desk which

the telephone is located. A remaining station clock insulation, overhead steel rigging and all other equipment is concealed, making the entire operation one of the most complete in use at any target. The entire system is such that one operator can handle the telephone, as well as customers for the station, and also serve as a gunner for the gun at any particular time. In one series of tests, during a single exercise, once firing a bullet goes up in the control room. This starting gun was over the distance thus taking up little space which might otherwise be used.

beverage seems in order that there is no conflict between this item and figure.

Traffic at the South Dayton station is at the present light enough so as to warrant continuous control tower operation, but in the design of any installation of this type, it would be well to consider a tower which would be in the tower when all airports will probably become even more crowded than they are now. A much-needed airport tower light gun has been installed and on January 10 other long days it will be in operation. There is no immediate consideration being made for installation of radio facilities at South Dayton, but the tower is admirably designed to accommodate such equipment when the need arises. On the outside of the tower, just below the top, there is an antenna which carries every airport light gun—therefore leveled clouds would drift from the light line. So there is a liability for erroneous reading trips in case the clouds begin to drift, and that is a very dangerous addition.

The rest rooms, as mentioned before are located south of the lounge and are entered from doors which are on the outside of the building. The water is available at all times from the heating tank which is located in the cellar. By fortunate coincidence, a natural gas line passes very close to the club house making it possible to use gas for all heating purposes.

The construction of the South Dayton club house answers many problems along this line. The cheapest possible method of fabrication was used and probably

Consider
**PERFORMANCE
FIRST...**



- - - WHEN

SPECIFYING AIRPLANE ENGINE INTAKE FILTERS

WHEN war was declared, American industry ceased its experiment and turned all its tremendous production capacity loose to make more and more war materials.

In the field of air filters for gasoline engines the period of experiments and research has just finished for all concerned. American Kerosene Filter engineers had already developed the right type of filter for gasoline and were ready for production. This prompt response to the request of Army engineers and aircraft manufacturers for an engine intake filter that could perform under any and all conditions was made possible by their twenty-two years' experience in the field of industrial air filtration and dust control.

AMERICAN AIR FILTER CO., INC.
INCORPORATED
304 Central Avenue Louisville, Kentucky



Brazil Aviation

(Continued from page 39)

Air Force would have preferred American machines but they were too costly to them. German, just outside Belo Horizonte, the new Latin States factory is now being considered. It is a major project on the part of the Federal Government and an antecedent. A large landing field for non-stop flights of long haul is laid out on a belt of land. In the flat valley below, the first of the factory buildings has risen. Beyond, at a still lower level, is a small like fire hydrant testing. A ramp leads from the factory to the flat. This present development is planned to produce 100 North American 44 aircraft annually. The first will be delivered in a year. The second will be delivered in the location, the seventh will be built in the city and all machines must be taken from there to the factory by truck but a two day gap can be throughable. Production is expected to begin early in 1942.

Sao Paulo has a forty small factory which has just been given an airworthiness certificate for a new lightplane, the Yastar 20. The designer and owner is P. G. Roder, a young man, but Roder is enthusiastic. For years, Roder has been building small shops from parts of scrapped cranes. The new plane is a tandem gainer with much the same basic as a Piper Cub but with nose-aileron, rudderless characteristics. It has Loehman type flaps and a single trim tab just as the right rudder. Roder has capital available to build a plant that will turn out his planes, a small plant at the airport and a larger one in the city. He has a present contract for the total Air Force requirement of 300 planes—and a good number of these are trimmer and single aileron types.

The amalgamation of the new Passo Fundo will change the picture somewhat, were they will make possible help from us, if it should be needed and asked. But no one in Brazil feels that there will be military help. National pride is too great and the idea of foreign intervention is too abhorrent to most Brazilians. The agreement between Passo Fundo and the Government, on the surface at least, is entirely commercial. It is written to run for 20 years and the company is required to build the fields and make the installations, including hangars, administration buildings, radio equipment and weather stations. The company will be granted certain rights and the right to charge a fee every year that it is paid for by the aircraft companies using the airport. At the end of the contract the latter will all equipment become the property of Brazil.

The São Paulo is one of the largest and most important of the five. It has an excellent location and is open and free of obstructions. At São Lourenço do Maranhão, the second of the states, the present military field is being improved by runway extension and modernization of the same type.

The Belo Horizonte is located ten kilometers north of the city and will be finished within six months. The famous Jatobá Club at Paranaíba has a pet joke that has been going

the rounds about the airport. According to the club wits, they can no longer serve their famous "monkey steaks" because—José Geraldo Neto, Marquette Polytechnic graduate who is the supervisor on the old site, has taken them all.

The final two bases at Araxá and Montes, the one to the south and the other to the west, are in the month of the Amazon, and also have been the signs of development. It is more or less true that in all cases, schedules are being maintained, even though the greater part of the work is done by hand labor—with steady assistance.

There is another equally interesting development taking place up the Amazon. Until now, it has been recognized that it was impossible to build airports in this vast expanse of constantly changing terrain. After Almirante Tamandaré, a dredging plan was set up at Coronelzinho, Santarém, Pará, Pará, and Manaus. These will be finished early in 1942—the entire job having been done in six months. The Government engineer in charge has used a traveling labor force of eighty men, surveying and building as he went. The fields are, of course, of mineral soil, which already have soil-draining, and are rapidly becoming saturated. They will all be equipped with small radio and pilot houses.

In these simple projects lie the basis of the future of the entire river area. Midway aerial service will begin as soon as the fields are ready and from shore on, combined with the Pará extension and the training program of the Avro Club, the possibilities for passenger and cargo transport are very great.

Landed at approximately, this American development is typical of the eastward movement of transportation in Brazil. With the exception of the Litorânea, the main direction of road extension has been in three sections. Pan-American's Caudilho does fly a transverse front north to south, but this is a coastal, semi-tropical service, with only a few landing points. Haroress, the Amazon, the Tocantins and the São Francisco are the only major rivers carrying passengers. The new B&B line is along a sector of the São Francisco route but it is still in its infancy. The second east-west sector is a quadrilateral to the north and west of Rio, connecting Belo Horizonte, in the heart of the great mineral area, Goiânia, center of the state boundary; Corumbá, the link with Paraguay's Trans-Bolivian line and San Pedro, and the transcontinental steamer port on the far side of the square through Campo Grande and São Paulo back to Rio. Passo do Sul, Serraria Gondor and VASP all furnish

aircraft instruments . . .

how to use them
how to test them
how to repair them
how to install them

JUST OUT!

GEORGE E. IRVIN'S

AIRCRAFT INSTRUMENTS

THE full and explicit treatment presented in this book is in accordance throughout with manufacturers' recommended methods and airline procedures for all operations covered, and includes copyrighted information from these sources as well as working charts, formulas, tables, trouble-finding lists, etc., not heretofore available in a single book.



Tells you all you need to know about:

metronome	radio reflecting	passenger seats	basic indicator
aneroid	systems	instruments	artificial horizon
stabilizer	inertial	inertial	gyro
pitot	inertial	inertial	rotors
shock	inertial	inertial	assessing of
monoid pressure	inertial	inertial	airplane stability
gauge	inertial	inertial	and control
altimeters and	inertial	inertial	surfaces
clinometers	inertial	inertial	
fuel quantity	inertial	inertial	
gauges	inertial	inertial	

608 pages
6 x 9
\$15.00
**SEE IT
10 DAYS**

McGraw-Hill Book Co., Inc., 333 W. 42d St., N. Y.
Send me *Aircraft Instruments* for 10 days' examination as expressed.
In 10 days I will send you \$15.00 plus postage postage or return book pre-paid. (Shipping paid on return unaccompanied by remittance.)

Name _____
Address _____
City and State _____
Position _____
Company _____
Book sent as express in U.S. and Canada only.)
AM 142

Published by
MCGRAW-HILL
BOOK COMPANY, INC.

serve in parts of the central sector. The walk is almost equally divided by the lines from Cañada to Asuncion, and from Paranaense to Poeta Miguez, with offshoots to Diri and Tarija. By encouraging emigration in the three areas, Yrigoyen has established contact with Peru through the Tarija line; has Tarija, on the Arica line, to Bolivia at Coroico; to Paranaense at Asuncion; and to Argentina and Uruguay over the international routes along the coast. It is symptomatic that all these areas was to undergo considerable emigration, and which has been markedly decreasing; good relations have been established with Paraguay, Brazil, and Argentina.

The near future should see three great transcontinental air routes connecting to rapid communication and resulting commercial and political benefits. The present trans-Andean route between Buenos Aires and Santiago is far from ideal, so the San Salvador Corridor, connecting via Brazil's Pará to the northern part of Paraguay and the northern end of Argentina, The Rio Corridors has made fast connections with Bolivia and central Peru. The Puma extension to Tabatinga, latest a gap of only a few hundred miles from the Amazonian cities of Belém and Santarém in Pará, which is now connected from Lima by daily regular cargo and passenger flights of a Peruvian company. If another line should later be dropped down from Misiones via Corrientes to Yerresque in Mato Grosso do Sul, a trans-Andean land-based air route could be opened up to even more exploitation. A number of the potential routes have already been suggested, like the United States, working in cooperation with Brazilian experts.

Economically, socially and politically Brazil has everything to gain by an expansion of her air transportation system. With 90 percent of her resources un触ched, and a population of only 44,000,000 in a country that can, it is estimated, support 360,000,000, the driving factor is positive for oil extraction and her Government is beyond question.

Statistics for 1949 Air Compared with 1939
Number of Accidents: 279; 21, 1939-1949
Number of Fatal Deaths: 24, 1939-1949
Number of Commercial Passengers: 1111; 13, 1949-
1939

Saints of Divine Ports: 1999: 138–144
1,418
Saints of Werlberg, FCN: 98: 1991: 261
Saints of Kaufbeuren, FCN: 6: 1991:
138.
1,250 further see also *Appendix of 250 S.*

Ready for Defense

(Continued from page 207)

the house could easily offend. The entire structure is made from rough logs which are cheap and quick to construct—rugged logs come from northern forests such as Wisconsin and the Great Lakes area. With a log house there is no need for elaborate exterior finishing, as very little exterior work is done—actually a log house looks like it stands there.

Rooms inside the log house are shallow, concrete rooms separated by the exterior of the building. The exterior wall is covered with a layer of lumber. The building was designed by Ray Parrish, Dayton architect, and constructed by Ray Vaun, D. Elman and LeVan, local contractors. Due to delays in getting materials necessitated by the national steel shortage, the building took nearly four months to complete. A six-ton wooden sugar wagon, materials, the entire structure could be completed in thirty days.

The entire cost of the building including all fittings, and equipment, was less than \$1,000 despite currently high construction costs which included \$10 per hour for labor. Under normal times probably the job could be done for twenty percent less. The price does not include landscaping but this item is something which can be developed gradually over a period of several years.

The general acceptance of the idea among local Dayton citizens indicates the extent of this type of operation on a general basis throughout the country at present. One reason is that in the South Dayton field one can see instances of many prominent teachers either taking, or instructing or flying their own planes. Most of the persons who own airplanes surrounding the airport are taking up some form of flying and it is evident that they do this because they have never been compelled to do so if they had to by from a managerial or from some other kind of commercial aspect. Otherwise himself says, "I think that this type of development is similar to general good practices in business or in anything else. If you want to succeed you have to do something which you can accomplish here in the neighborhood or a grocery store by the back door."

The development in South Korea

is now done on a purely commercial basis, the entire construction being undertaken by Air City Flying Service. The author is a great believer in providing flying clubs and sees his best hope lying along the club plan. His chief aim is to organise a flying club with fifty members with three or four aircraft, finding that this affords much more flying time per member than small clubs such as one plane.

There are no systematic changes between data that are obtained because of a natural increase or decrease of present values. Thus through the club house, will be the only thing required to pay just what is due.

More opportunity will be given that present capital would not have been used if such contributions were not taken. Free thousand dollars, so many of them, is indeed a large amount from which returns may not be received for a long time. However, even so, can work in generally a very poor way of community where there is a group of interested persons.

Elmhurst, Glenview, and Des Plaines, Ill., there are associations of club buildings of a less permanent nature than the Dayton Club. These clubs are not able to pay their debts through membership dues. Income from functions such as bingo games, dances, shows by

etc., etc.). The Ellington club house is an interesting example of an inexpensive building for a small town. The building is one large room, forty feet long by twenty feet wide, with a high ceiling, and no interior partitions.

In one corner there is a small office for the operator. It was built at a cost of \$1,000 for the Condor Flying Club at Zanesville club was built by the flying club and represents a budgeted type of building of structures which often necessitate.

It is approximately thirty feet by forty feet in size, a large mass of brickwork and cost in a neighborhood of \$2,000. That was the case, however, as many enthusiasts have been compelled to build their own flying pens, as it is estimated that each and in itself, which every airport operator should consider.

The important conclusion which we draw from this article is not just a request country clubs use size and sensible design. The Boston development points out what sound marketing practices have come from other types of business than the aviation industry. It shows how an amateurish field has represented the airplane operator in the public mind and advertising, and also how, as well as at a warning signal, the expert operators, who are already enormous and going to increase even more, the aviation public will respond.

A Statement

MORE than 3000 different products now are being made for the aviation industry alone. Hycar, the versatile new synthetic rubber with the properties aviation men have long been looking for. Over 3000—and the list is growing rapidly.

Want to bring your own.

Gasoline tanks	Rail tanks
Gasoline base	Tank trucks
Ammonium salts	Diaiphograms
Oil base	Gnomes
Fusible cups	Seals
Padlings	Extruded and Molded Parts and more more

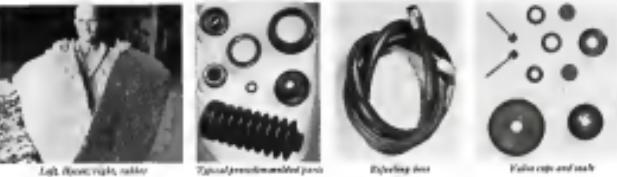
Hytre is being selected by aircraft engineers because of its light weight (specific gravity 1.000), a superior resistance to extreme gravities and cold, a resistance to heat and an resistance to cold flame.

Hynes is being reflected for the extreme pressure which it can be influential, as educational policy re-invents the dimensions and objectives of the practice of law and on

Your rubber problem supplier can furnish you with parts made with Hycon at any desired hardness, from soft to bone hard, and with an operating range from -50° F. to +350° F.

With the outstanding advantages of this All-American system: We will be glad to work with your own supplier in development of the source animal for your needs.

HYCAR
CHEMICAL COMPANY
AKRON, OHIO



ESTILOS 2007 109

French Lesson

(Continued from page 47)

Frenchmen, and with the incents of the first sit-down strikes, as power increased. They could count on little opposition from the Government. Many strikes grew from local and hostile units they reached an all-time peak of 4,000,000. However, there were many thousands of workers among them who were not in sympathy with either the Free Pétainists or the CGT. Many belonged to militant groups of the Right, as the Croix du Feu, but had joined the CGT to keep their jobs. The CGT invited a closed shop. Numerous workers were forced to join it, even though they did not want to change their ways. Work of non-unions was sabotaged, roofs were lost, they were refused entry to their workshops. Employers were threatened with further strikes if non-unions remained on pay rolls. Millions of francs in dues were paid into the coffers of the CGT. Corruption was rife and rampant. Jobholders had to have turned onto a big checklist as an incentive to give up. The Government was reluctant. Eight more brigades between the Souleuvre and Rethondes-Saintonge. The people of the Center and Right were indignant, and these excluded thousands of workers. Employers are under pressure to make up to the Government. They were able to give back by sedition. It was always a one-sided battle. M. Leon Blum was giving France a New Deal. He called it "the greatest social experiment in the history of the Third Republic." And, we ought to add, it was equally favored by the Third Republic. The German Army favored the knockout blow.

After the success of the first twelve strikes in May other strikes broke out everywhere. Automobile manufacturers of automobiles and machine guns were occupied. Anson, Thomson and Dresser, aircraft contractors working on government contracts, were occupied. The Renault factories, the largest in France, who employed 34,000 at the manufacture of aero engines, armaments, trucks, and war equipment, were occupied. The employees locked themselves in with M. Louis Renault, the Pontiacs, who gave in to their demands. Automobile factories in Châlons, Lille, Poitiers, Paris, Hippo-Saint-Omer, Rouen, and Soissons were occupied. Renault and Salmson were occupied. Béthune and Sétif were occupied. The last of the National Defense, Givors and Rives, had their sit-down strike. So did Goodrich Tires, and Alsthom, the American plants. At one time as many

as 70,000 workers engaged in armament industries were on strike. On June 15, after the workers had received pay increases of 12 percent and 15 percent, an estimated 1,000,000 employees were on strike. The automobile, aircraft, textile, metallurgical, munitions, and mining industries were paraded. M. Joubert addressed the press that he struck with the workers.

Under the bill of the Free Pétainist Government there would hardly a strike where there was not a strike in some key industry. When one was settled others broke out. Metal workers struck early and often. Taxi drivers struck, as did sailors, shop employees, government clerks, bakers, meat drivers, miners, rice trade employers, steam cleaners, carpenters, bus drivers, insurance agents, radio gauge, electricians, bookkeepers, laundry workers, and operators.

During June, for example, some 4,000 workers for the Renault strike Department store employees staged a stay-in strike. Employees of the Americas Hospital in Neuilly had their strike, much to general consternation.

There engineers, mechanics, laundry workers and laundry workers and laundry workers demanded lunch, a 40-hour work week, recognition of CGT benefits and added a demand for a minimum wage. Several weeks ago the laundry went on strike. They were more disorderly than any others. At first they took up their hunger and fight and quit work. The Commissars' signatures, as it is always, showed that a new form of import protection. Bargains were tied up in town, many deep across the Seine, the Oise, and Ardennes canals, thus effectively blocking all westward movement.

Sabotage continued without cessation to the general detriment of business. Production was so reduced that many factories had to be closed. Delivery dates were not met. Workers who had been on the part of labor. Foreign business houses refused to do with French firms. What were the strikes for? The workers had been granted three original demands: that the CGT should be the sole organized body of workers; that the workers should be persons of self-interest; as to increase their power. Some strikes were spontaneous, those beyond the control of the CGT. There was a strike for a better history in one factory. There were strikes against employers' profits, and there were strikes demanding that married women be released in factories where husbands were employed. In the Gobetot Tire factory there was a strike because a delegate was demanded for toppling down a statue of the Maréchal from the office. If no employer fired a union man for such a infidelity there was a strike. If he employed non-union men there was



Among the many aviation leaders who agree on the importance of Purolator-protection are:

BREWSTER • CONSOLIDATED • DOUGLAS • FAIRCHILD

GLENN L. MARTIN • NORTHROP • REPUBLIC • SPERRY

FOR LUBRICATING OIL In the plant



Purolene filters of all sizes are now widely used to guard against the dangers of dirty oil in black runs of aviation engines. Purolene meets this problem, too, with the experience gained in producing the majority of the filter equipment used on gasoline and Diesel engines of all kinds.

FOR HYDRAULIC CONTROL SYSTEMS in the plane



Used in original equipment by practically all leading airplane builders, the G-160 Purolator is a thoroughly dependable filter for secondary hydraulic systems installed for the operation of wing flaps, gear tanks, retractable landing gear, and other devices. This model will handle 15 gpm at 100 PSU oil at 100° F., with a maximum of 12 lbs. pressure drop. Operating pressures are up to 1500 lbs. Filtering elements have a spring of .025". Weight only 14 lbs.

The G-160 Purolator is specially developed for use on the suction side of the head pump in emergency盛放 controllers. It may also be used on the discharge side of the hydraulic pump, handling 15 gpm at an operating pressure of 1500 lbs.

PUROLATOR PRODUCTS, INC.

Home Office: Newark, New Jersey • California Office: 1401 South Hope Street, Los Angeles

PUROLATOR OIL FILTERS

knowing that they would be left off on completion. Meanwhile work continued without interruption on the Belgian, German, Italian and Russian pavilions. They had usurped their own services for this purpose. On the opening day no French pavilions were ready, though the French Government had been given a six-months grace period. The workers labored through the summer months, finishing one pavilion after another and as construction was virtually finished by the beginning of September, the French work took no longer. The workers were in no hurry, however. The French Government could not afford to have its pavilion completed earlier than the others, so the workers delayed and dawdled, and most of them spent their pockets paying the dealers who sold in rooms from the Government.

The battle line of the workers under the *Frente Popular* was "Up! Up! La Pura, La Lucha!" that is, a broad front. Like the English, the French did not consider the workers as a granade. De Gaulle was making up to their wage increases. Brest went up to its peak. There was no mass peace in France as at the time of the Revolution. There were frequent clashes between Right and Left groups. Particular attention was having everywhere in sight the *Frente Popular*. The Bourgeoisie was not so easily taken in. They worked out various ways to stop the C.G.T. It postponed. But their Merry was being taken away. In the course, workers were more cautious because they saw with sides. In the Peugeot automobile factory there was actually a strike against authority. At priests were up, there were strikes for further increases in wages. Garbage collectors left refuse on the streets. They were not paid for their work. In 1950 a man can leave the place. There were governments of discontent. The workers' strike had been glorified. The sense of victory hung over France.

On the 15th of March in 1937 a General Strike was called in Paris. For Joadah, it was a test of strength. It was called in defence of M. Blum, the Socialist Prime Minister, issued by the CGT, the Socialist Trade Union with which he had been in close agreement. He did not take any direct part, though the slogan demanded it. He was under obligation, no longer as a result of all sorts of transportation in Paris itself to a smash-and-grab gang who ate at leisure, sleep, change, let his shirt in disorder. Bazaar shops, and factories were closed. None of the smaller shop-keepers had fear of Red demonstrators. The sons of honest workers were frightened. They adhered to the C.G.T. and the strike. They were then given little time to work. This gave

not liberty. A man's position on standards, but a man's later years, and a deterioration of power. The Government did not like it but had to act. Industry did not like it but was powerless to act.

While Louis' disastrous economic policy was not safe, the *Front Populaire* Government was making drastic changes elsewhere. In the first ten weeks at their disposal, the Left Government passed no less than 60 bills of revolutionary character affecting the economy of France. These ranged from new taxes, decentralization, the nationalization of insurance, railways and the steel industry, partial nationalization of the banks, the abolition of the Chamber of Commerce, and many others. General Jeanne d'Auterre-Saint-Exupéry, who later command-mailed a petition against the departure of 200 families, who owned the vast stock of the *Front de France*. The Board of Regents was therefore represented by a committee of nine ap-

members of the Blue Government did not believe sugar and its products were ever threatened. As the situation grew worse, the Blue Loyalists wanted dredged that money must be loaned to them from the people on their lands. The public addressed it as follows, "We hope you will agree the government is in a deplorable state."



Introduced by AMERICAN CHAIN & CABLE

Illustrated here are a few of the new aircraft control systems developed and introduced by the AMERICAN CABLE & CABLE COMPANY, INC., and since being used by leading aircraft manufacturers. These fittings develop the full strength of the cable yet have a compactness never before attained.

It is only natural that American Chain & Cable Company should be the first to develop the ball type annealed fittings. This organization has repeatedly been "first." It was American Chain & Cable who developed the conformed type of wire rope—the performing process

alone making possible the use of the *runged-on* "tunis" type of fitting.

TRILOCTYTTES have long been recognised as the one type which develops the fullest possible capacity of both oral and fitting. Now the ball-type, the ball-with-shank type of fitting is equipped with special cycles or

Don't fail to write today for your copy of the new *Resonance Chorus & Cable Control Booklet*. Address the district office nearest you.

AUTOMOTIVE AND AIRCRAFT DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT

6-235 General Motors Building, Detroit 230 Park Avenue, New York 630 Third St., San Francisco
2675 Flower St., Los Angeles 504 S. Central Ave., Wichita

Write for Booklet on these New fittings

**UNCLE SAM
HANGS UP HIS COAT
and goes to work!**



**Chances are he's hanging
it in a PENCOP LOCKER**

Every day throughout the war in Unity Saco workers hang up their coats, roll up their sleeves and go to work for the defense of Democracy. Thousands of men are passing their best efforts into the gigantic task and courageous belongings at Penn-Cobalt—the leaders who build all defense requirements.

To meet the vast and the ever-increasing and often advanced weapon equipment, it is often necessary, Penn has adopted a "Steady Flow" policy. The new Penn Tool Stands and Cabinets are designed in all publications—Penn tool styling—executive name for efficient and simplified working.

Additional service points and information can be found in the numerous plant facilities provided by Penn engineers. Investigate the PENCOP advantage for your plant.



**Steel Lockers & Shelving
Storage Cabinets
Tool Stands & Cabinets**

**Penn Metal Corporation
of Penna.**

In Business Continuously Since 1889

32 Oregon Avenue, Philadelphia, Pa.

Defense. To them it seemed a reversion of the old form of government that could do little more than muddle along like this was a time of emergency. It was no time for muddling. They clamored for strong government. France was nearest.

While the Chambre enjoyed a respite, M. Deladier was given plenary powers by the Senate and Chamber. Immediately he went to work to increase the 40-hour week to 50. This was followed by a series of pronouncements from the C.G.P. The workers at Renault declared a strike. M. Deladier sent General Mirabeau, or State Police, to round up workers from the factory. His swift action was applauded by many. But the C.G.P. didn't like it. Later, M. Jouhaux demanded a general strike, but never again. M. Deladier got enough French to no longer be a threat to take with him. It was agreed that he would not make any further effort. The Maréchal Tropes were ordered in immediately. The strike stalled. The workers were left up with nothing and remained at work. Their refusal to strike was highly significant. Many recognized that union members forced workers to strike.

The story of the French Air Force is linked with politics and predominantly those of the French Air Ministry. The Air Force, as it stands today, has always been a rather unfortunate weapon. It was created by General Georges Clemenceau in December 1919 and passed under the control of the Ministry of War. Pre-war French military aviation came under the command of the Ministry of War and served the army in co-operation. French Naval Aviation has always been under the command of the Ministry of Marine. In 1934 planes were made up to reinforce the air fleet and bring it up to date. The number of aircraft increased to 1,000 by 1936. This number was later increased to 1,500 by General Denain, while he became Minister of AAF. It was soon discovered that the French aviation industry was not equipped to handle contracts of such size, and much time was lost while new machinery was being set up. Completion of this plan was further lagged down by technical problems, administrative, and industrial delays, and the program was not achieved until August 1937. At this time three or more older planes between the drawing board and delivery to a squadron of a new self-service machine, the French Air Force was then composed with but half-manned aircraft. In the meantime Germany had started from scratch and now had almost double the French Air Force.

Starting and the 40-hour week during 1936 and 1937 induced production in its present state, monthly production being

as slow as how to start machines. During this time the industry suffered to a near demoralization stage, which further slowed production efforts while reorganization was effected. The Nationalization Act, passed by the Free Republic, while M. Pierre Cot, was Air Minister, gave the Government the right to buy or otherwise acquire factories and manufacturing rights. Purchase automatically gave the Government a one-third interest in all aviation firms with a 50% option. Many factory technicians were replaced by government experts, and made contributions and suggestions needed.

Under M. Deladier, with M. Guy La Chambre as Air Minister, a new program called for 3,000 first line aircraft including reserves, and 32,000 machines. This was to be completed in two phases, the first ending in the Spring of 1939, the second in the Spring of 1940. Aircraft with long distance journeys, like Douglas, were chosen. A 20-hour week for all employees engaged in government work, as mentioned. But during this time German aircraft workers were moved to be working for 80 hours a week.

Between January 1 and September 1, 1938 French production amounted to only 287 aircraft. Between September 1 and December 1, 1938 machines were built. Such was production as a result of the reorganization of the industry, work and political conditions. The Deladier programme, known as Plan V, called for a production of 300 machines a month by the spring of 1939. At the outbreak of war, the industry is believed to have reached that goal, but it was never enough, and the effort came too late. The Luftwaffe had six machines in the class to use France during the Battle of France. The results were good, and the Maréchal, however, had the necessary not enough of them. Their loss of five Bf 109s aircraft had also been augmented by an order for 600 American machines, which was put through in spite of opposition in the Chambre, and by the industry, who estimated that they could supply the necessary aircraft for National Defense. In 1938 French aircraft production amounted to 1,600 machines.

The Air Force in 1939 consisted of 2,000 officers and 27,250 men. In 1939 there were 3,000 officers and 39,418 men. Plans were under way to expand the Force to 150,000 men of all ranks.

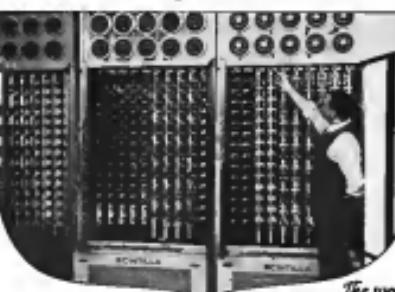
Now that America is at war it is my fervent hope that all of our production facilities will be used, but there are symptoms that perhaps that may not be entirely true. The French lesson is simple and clear. We cannot tolerate any slippage of work or any relaxation of the intense industrial effort which is the primary ingredient in victory.

DOUGLAS DC-3
Luxury Airliner
Equipped with
SOLAR
Exhaust Systems

Solar Aircraft Company
Main Office and Factory
SAN FRANCISCO, CALIFORNIA
Sales Office and Factory
PHILADELPHIA, PENNA.

Pencop Aeroplane, Solar Equipped - Sixth Advertisement of a series

They have to be
PERFECT TO SURVIVE
and every Bendix-Scintilla Magneto
Coil must pass this ordeal



Tested under the most careful human supervision each magnet overlooks hours of intense heat in this oven chamber. "Professor Quo."

Here only coils are tested before they go into a Bendix-Scintilla Aircraft Magneto. After a short time in the oven temperature is increased to 1,100° F. and maintained. Each operation performed during the entire conduct inspection. Then when the parts comprising a coil have been tested, the coil is completely tested on the device mentioned herein. After this test, the coil is assembled on the magnetic ring in which it is then subjected to several tests in a special multiple heat bath.

As an important statistic, doesn't it? In the early days living in America's defense is more because we do it.

BENDIX-SCINTILLA DIVISION

Bendix Aviation Corp., Roslyn, New York

**BENDIX
SCINTILLA**

The world's finest aircraft ignition

Hydraulics

(Continued from page 87)

center with the radius of the nose and (2) a square bearing block which with the plunger mounted at its center of gravity, is mounted on a sleeve bearing. The pump is placed horizontally so the sleeve bearing is at the center of the pump. The plunger has a small bearing surface which is mounted in the cylinder. Thus when passing over the ports, oil is drawn in on one end of the plunger and discharged on the other.

The great disadvantage of this pump is the single plunger, even though it is double acting. Output necessarily must be quite small and pressures are quite high. The advantages of this pump are that it is exceedingly simple and cheap to manufacture. Pumping is of the type known as rotary pumps, not resembling piston or plunger valves. For very small pumps which do not have large requirements in hydraulic fluid, this pump has a definite place.

The Victoria Aviatic Co., Ltd., of Great Britain, is in no way connected with Victoria, Inc., in this country, produced a two cylinder pump the size in diameter. This pump, shown in Fig. 3, consists essentially of two horizontally opposed cylinders and two plunger valves joined together in the center by an eccentric drive. The housing is enclosed from a durability, bearing and corrosion test and cylinder liners painted steel plate. The eccentric drive, made of high grade steel, is part of the eccentric shaft containing the eccentric drive and rests in bronze bearings. A counterweight is mounted in a slot in the eccentric shaft to provide the resulting and counteracting lateral forces.

In operation, oil is drawn in through the entire pipe through a connection in the mounting plate. When one piston is on its lower stroke of piston through port "A" and through the main discharge valve into the cylinder. Oil is returned while the discharge valve is closed, and the oil passes through a spring-loaded valve which opens into the outlet ports and passes through a filter back to the reservoir.

The characteristics of this pump are as follows: Since it has two pistons the discharge flow is pulsating. Also, the use of eccentric valves requires a lot of low operating speeds so that the cylinder must be quite large to give a delivery of any required capacity. The need for countershafts reduces the pump's efficiency and life. Because of these gross disadvantages this pump has not found much favor in aircraft hydraulic systems.

The rotary radial type of pump has

been considerably well in multiple piston arrangements. In view of the increased pressure or piston plus the shear stress allowable, it is possible to obtain a relatively quiet-operating delivery as well as more tools than ever before. The piston can be arranged in banks of one, two, three or more, thus allowing for extremely large deliveries when pressures required are dependent only on the length of the housing to carry the load. The piston are joined in a manner to prevent rotation of the outer cylinder blocks, which is done by means of a locknut assembly which is utilized to hold the intake and discharge ports. These ports are carried through the housing to intake and discharge outlets properly placed on the outside surfaces of the shaft and also to fit into intake port connections. The star member is interconnected to the pump housing so that the piston will reciprocate as the star member rotates.

The most important, from point of service and reliability, is the type of pump of the Messier pump shown in Fig. 4. This pump is manufactured by the Messier Aviation Pump Company in France, and used throughout Europe. These pumps are remarkably light and capable of operation at pressures up to 2000 lb per square inch. Maximum delivery is quite small. Increased delivery can be obtained either by increasing the number of pistons or by increasing their displacement. Pressures above 2000 lb per square inch are obtained by using two piston units in series, which is about the same as having double bearing on the pump. Although the first star member rotates, the valve shall not be held very close the distance between the seated ports on the outer shaft to avoid seal damage.

The Messier pumps are unique in that they incorporate a means whereby the pressure may be changed from the direct to hydraulic power as required. However, the pump is not self-priming. Hydrostatic pressure is used to prime the pump. The pump incorporates a mechanical release. This design is illustrated in Fig. 4. The pump consists of two cylinders placed radially in a rotary pump block. The block is machined on the longitudinal axis of a main shaft and rotated eccentrically with the pump housing. The main piston shaft against which the pump rotates is secured in a fixed position and which is connected to a gear which is connected to the pump housing. Each piston has a valve equal to twice the circumference of the outer (piston) block and executes a complete cycle during one revolution of the pump. The pump is mounted on a single plunger shaft with clearance between them held to an absolute minimum. Intake and discharge ports are milled on the surface of the cylindrical shaft and parts are drilled from these slots inside the housing to the pipe connections on the outside of the pump. A non-return valve is

ACTUS HOSE CLAMPS

Do the JOB...the Easy Way!

1. One Clamp fits any size hose, $\frac{1}{2}$ " to $3\frac{1}{2}$ ".

2. Quickly installed before or after assembly.

ACTUS Hose Clamps are now used by the U. S. Navy and Coast Guard, Canadian Government and many of our principal aircraft and engine manufacturers. Write for particulars.

Approved by C.A.A., U.S. Ordnance Dept., British Admiralty

ACTUS PRODUCTS CORP.
MOUNT VERNON • • NEW YORK



DON'T WISH YOU WERE AN
AIRPLANE PILOT OR AN
AVIATION MECHANIC

come to

**Roosevelt
Aviation School[®]**
AND LEARN TO BE ONE

Approved by the U. S. Civilian Aerobatics Board. Recommended by the U. S. Army Air Corps.
Learned by the Work of Many Years.

**SPRING CLASSES
START MARCH 30, 1942**

AVIATION TRAINING AT ITS BEST

SIGN AND MAIL COUPON TODAY

ROOSEVELT AVIATION SCHOOL
at Roosevelt Field, Mineola, Long Island, N. Y.
Without obliging me, send details of course offered:
COMMERCIAL PILOT COMMERCIAL FLIGHT INSTRUCTOR
PRIVATE PILOT COMMERCIAL AIRPLANE & ENGINE MECHANIC
Name _____ Age _____
Street Address _____ Zip _____
Phone _____

cylinder or any other hydraulic device, the pump will not run and deliver fluid under pressure to that device. In most of the positive variable delivery type, the quantity of flow is automatically regulated to suit the requirements of the device being operated.

Fig. 6 shows an exterior view of the Dowty "Live Line" pump. Fig. 7 illustrates cross-sections of this pump. The general assembly of the pump is shown in Fig. 26. Fig. 27 is a cut through the pump, showing the pump in position when the pump is not delivering any flow. Fig. 28 is a cut of the same

arrangement when the pump is operating in the housing and in the full pressure stroke position delivering its full capacity. Fig. 8 is an exploded view of the Dowty pump illustrating its construction.

With reference to Figs. 7 and 8, it can be seen that the pump consists of a roller block, a star member which houses seven closely fitted and packed roller bearings. The roller block is fixed to the housing of the pump by bolts and nuts bearing for it. This distributor shaft is stationary and carried through the pump and mounted on the carrier casting. Inlet and discharge ports are milled on the shank casting. Ports are drilled through the shank so that valves and pipe connections as in the master pump. A pivoted dipter lever is mounted on each piston by means of a pin through its fulcrum. These levers have a slot in them so that they may be locked when a pin is driven into a lock edge slot which at one turn from a position concentric with the distributor shaft to a position opposite with it. A curved leaf spring is bolted on one end to the track ring while the other end bears with considerable load on a pocket provided for it on the pump housing. A light weight cast housing contains the pump mounting bracket and is bolted

to the carrier plate.

In operation, oil is drawn into the nose through the suction connection. The rotation of the cylinder block sets the oil in motion and it passes by centrifugal force through a duct into a channel formed in the distributor shaft in the reaction port under the piston as they move upward. The centrifugal force bearing on the piston creates pressure on the cylinder. The outlet of the pump passes to the reservoir. On the downward stroke the oil in the cylinder is forced out of the discharge port as the cylinder passes over it. The curved leaf spring acts as an Elastomer, forcing the track ring clear to maximum stroke. This arm collapses when maximum high pressure is reached allowing the track ring to swing back concentric with the distributor shaft.

The Dowty pump can maintain pressures as 2,500 lb per square inch at constant operation. Pumps now in the experimental stage are capable of discharge pressures up to 3,000 lb per square inch, and it is hoped that production will soon be started on the higher pressure pumps.

There are a few experimental type radial pump type magneto-hydraulic pumps, one example of which is the Edgerton pump as used on the Douglas, DC-4. However, time and space of these pumps are in publication or available, they will not be discussed.

Binary Axial Pump

Based on many years' experience in manufacture of positive working gear pumps for air or moisture, rods and marine hydraulic equipment, Vickers, Inc., of Detroit, introduced about two years ago, their newest rotary axial piston pump. This pump is shown in Fig. 9. A cross-section of the pump, illustrating its construction and assembly is shown in Fig. 10. It is evident from the construction that this pump consists of a body of a three sheet steel cylinder block and piston to surround that they rotate about the axis at an



Fig. 6 Dowty Live Line Pump



Fig. 7 Cross Sections Dowty Live Line Pump

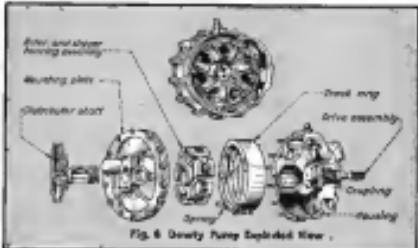


Fig. 8 Dowty Pump Exploded View



Fig. 9 Vickers Inc. Reciprocating Pump



If fastening operations on priority orders are bottlenecking your production line put HOLTITE Screws, Bolts, Specials and allied fastenings on the job. These accurate, sturdy, time-saving fastenings solve those costly assembly problems that plug production.

CONTINENTAL SCREW COMPANY
New Bedford, Mass. • Worcester, Mass. • Chattanooga, Tenn.



There's Nothing Unusual About This Telegram



Rush orders for standard NOPAK VALVES can generally be shipped from stock

A special service for exceptional times! We just received NOPAK screw strength up to 1000 lb per square inch. A complete line of standard valves and allied products including special parts makes this possible.

If your requirements call for special valves, or if you need special fasteners, get in touch with us. We have stock sizes up to 200 lb per square inch. Call or write for a catalog, or contact your local NOPAK representative or write Standard Manufacturing, Milwaukee, Wis. or a delivery office.

NOPAK valves are made of quality Thermoplastic.

NOVAL, The 3-Piece Operable Safety Valve
NOVAL, The 3-Piece Operable Safety Valve
NOVAL, The 3-Piece Operable Safety Valve
NOVAL, The 3-Piece Operable Safety Valve

Standard specifications for NOVAL, Ag or Hydraulics Cylinders with safety valves and relief valves, and applicable to sizes 20-inches, 32-inches, 48-inches, 64-inches, 72-inches, 80-inches, 96-inches, 112-inches, 128-inches, 144-inches, 160-inches, 176-inches, 192-inches, 208-inches, 224-inches, 240-inches, 256-inches, 272-inches, 288-inches, 304-inches, 320-inches, 336-inches, 352-inches, 368-inches, 384-inches, 400-inches, 416-inches, 432-inches, 448-inches, 464-inches, 480-inches, 496-inches, 512-inches, 528-inches, 544-inches, 560-inches, 576-inches, 592-inches, 608-inches, 624-inches, 640-inches, 656-inches, 672-inches, 688-inches, 704-inches, 720-inches, 736-inches, 752-inches, 768-inches, 784-inches, 800-inches, 816-inches, 832-inches, 848-inches, 864-inches, 880-inches, 896-inches, 912-inches, 928-inches, 944-inches, 960-inches, 976-inches, 992-inches, 1008-inches, 1024-inches, 1040-inches, 1056-inches, 1072-inches, 1088-inches, 1104-inches, 1120-inches, 1136-inches, 1152-inches, 1168-inches, 1184-inches, 1200-inches, 1216-inches, 1232-inches, 1248-inches, 1264-inches, 1280-inches, 1296-inches, 1312-inches, 1328-inches, 1344-inches, 1360-inches, 1376-inches, 1392-inches, 1408-inches, 1424-inches, 1440-inches, 1456-inches, 1472-inches, 1488-inches, 1504-inches, 1520-inches, 1536-inches, 1552-inches, 1568-inches, 1584-inches, 1600-inches, 1616-inches, 1632-inches, 1648-inches, 1664-inches, 1680-inches, 1696-inches, 1712-inches, 1728-inches, 1744-inches, 1760-inches, 1776-inches, 1792-inches, 1808-inches, 1824-inches, 1840-inches, 1856-inches, 1872-inches, 1888-inches, 1904-inches, 1920-inches, 1936-inches, 1952-inches, 1968-inches, 1984-inches, 2000-inches, 2016-inches, 2032-inches, 2048-inches, 2064-inches, 2080-inches, 2096-inches, 2112-inches, 2128-inches, 2144-inches, 2160-inches, 2176-inches, 2192-inches, 2208-inches, 2224-inches, 2240-inches, 2256-inches, 2272-inches, 2288-inches, 2304-inches, 2320-inches, 2336-inches, 2352-inches, 2368-inches, 2384-inches, 2400-inches, 2416-inches, 2432-inches, 2448-inches, 2464-inches, 2480-inches, 2496-inches, 2512-inches, 2528-inches, 2544-inches, 2560-inches, 2576-inches, 2592-inches, 2608-inches, 2624-inches, 2640-inches, 2656-inches, 2672-inches, 2688-inches, 2704-inches, 2720-inches, 2736-inches, 2752-inches, 2768-inches, 2784-inches, 2800-inches, 2816-inches, 2832-inches, 2848-inches, 2864-inches, 2880-inches, 2896-inches, 2912-inches, 2928-inches, 2944-inches, 2960-inches, 2976-inches, 2992-inches, 3008-inches, 3024-inches, 3040-inches, 3056-inches, 3072-inches, 3088-inches, 3104-inches, 3120-inches, 3136-inches, 3152-inches, 3168-inches, 3184-inches, 3200-inches, 3216-inches, 3232-inches, 3248-inches, 3264-inches, 3280-inches, 3296-inches, 3312-inches, 3328-inches, 3344-inches, 3360-inches, 3376-inches, 3392-inches, 3408-inches, 3424-inches, 3440-inches, 3456-inches, 3472-inches, 3488-inches, 3504-inches, 3520-inches, 3536-inches, 3552-inches, 3568-inches, 3584-inches, 3600-inches, 3616-inches, 3632-inches, 3648-inches, 3664-inches, 3680-inches, 3696-inches, 3712-inches, 3728-inches, 3744-inches, 3760-inches, 3776-inches, 3792-inches, 3808-inches, 3824-inches, 3840-inches, 3856-inches, 3872-inches, 3888-inches, 3904-inches, 3920-inches, 3936-inches, 3952-inches, 3968-inches, 3984-inches, 3992-inches, 4000-inches, 4016-inches, 4032-inches, 4048-inches, 4064-inches, 4080-inches, 4096-inches, 4112-inches, 4128-inches, 4144-inches, 4160-inches, 4176-inches, 4192-inches, 4208-inches, 4224-inches, 4240-inches, 4256-inches, 4272-inches, 4288-inches, 4304-inches, 4320-inches, 4336-inches, 4352-inches, 4368-inches, 4384-inches, 4400-inches, 4416-inches, 4432-inches, 4448-inches, 4464-inches, 4480-inches, 4496-inches, 4512-inches, 4528-inches, 4544-inches, 4560-inches, 4576-inches, 4592-inches, 4608-inches, 4624-inches, 4640-inches, 4656-inches, 4672-inches, 4688-inches, 4704-inches, 4720-inches, 4736-inches, 4752-inches, 4768-inches, 4784-inches, 4800-inches, 4816-inches, 4832-inches, 4848-inches, 4864-inches, 4880-inches, 4896-inches, 4912-inches, 4928-inches, 4944-inches, 4960-inches, 4976-inches, 4992-inches, 5008-inches, 5024-inches, 5040-inches, 5056-inches, 5072-inches, 5088-inches, 5104-inches, 5120-inches, 5136-inches, 5152-inches, 5168-inches, 5184-inches, 5200-inches, 5216-inches, 5232-inches, 5248-inches, 5264-inches, 5280-inches, 5296-inches, 5312-inches, 5328-inches, 5344-inches, 5360-inches, 5376-inches, 5392-inches, 5408-inches, 5424-inches, 5440-inches, 5456-inches, 5472-inches, 5488-inches, 5504-inches, 5520-inches, 5536-inches, 5552-inches, 5568-inches, 5584-inches, 5600-inches, 5616-inches, 5632-inches, 5648-inches, 5664-inches, 5680-inches, 5696-inches, 5712-inches, 5728-inches, 5744-inches, 5760-inches, 5776-inches, 5792-inches, 5808-inches, 5824-inches, 5840-inches, 5856-inches, 5872-inches, 5888-inches, 5904-inches, 5920-inches, 5936-inches, 5952-inches, 5968-inches, 5984-inches, 5992-inches, 6000-inches, 6016-inches, 6032-inches, 6048-inches, 6064-inches, 6080-inches, 6096-inches, 6112-inches, 6128-inches, 6144-inches, 6160-inches, 6176-inches, 6192-inches, 6208-inches, 6224-inches, 6240-inches, 6256-inches, 6272-inches, 6288-inches, 6304-inches, 6320-inches, 6336-inches, 6352-inches, 6368-inches, 6384-inches, 6400-inches, 6416-inches, 6432-inches, 6448-inches, 6464-inches, 6480-inches, 6496-inches, 6512-inches, 6528-inches, 6544-inches, 6560-inches, 6576-inches, 6592-inches, 6608-inches, 6624-inches, 6640-inches, 6656-inches, 6672-inches, 6688-inches, 6704-inches, 6720-inches, 6736-inches, 6752-inches, 6768-inches, 6784-inches, 6800-inches, 6816-inches, 6832-inches, 6848-inches, 6864-inches, 6880-inches, 6896-inches, 6912-inches, 6928-inches, 6944-inches, 6960-inches, 6976-inches, 6992-inches, 7008-inches, 7024-inches, 7040-inches, 7056-inches, 7072-inches, 7088-inches, 7104-inches, 7120-inches, 7136-inches, 7152-inches, 7168-inches, 7184-inches, 7200-inches, 7216-inches, 7232-inches, 7248-inches, 7264-inches, 7280-inches, 7296-inches, 7312-inches, 7328-inches, 7344-inches, 7360-inches, 7376-inches, 7392-inches, 7408-inches, 7424-inches, 7440-inches, 7456-inches, 7472-inches, 7488-inches, 7504-inches, 7520-inches, 7536-inches, 7552-inches, 7568-inches, 7584-inches, 7592-inches, 7608-inches, 7624-inches, 7640-inches, 7656-inches, 7672-inches, 7688-inches, 7704-inches, 7720-inches, 7736-inches, 7752-inches, 7768-inches, 7784-inches, 7792-inches, 7808-inches, 7824-inches, 7840-inches, 7856-inches, 7872-inches, 7888-inches, 7896-inches, 7912-inches, 7928-inches, 7944-inches, 7960-inches, 7976-inches, 7992-inches, 8008-inches, 8024-inches, 8040-inches, 8056-inches, 8072-inches, 8088-inches, 8096-inches, 8112-inches, 8128-inches, 8144-inches, 8160-inches, 8176-inches, 8192-inches, 8208-inches, 8224-inches, 8240-inches, 8256-inches, 8272-inches, 8288-inches, 8296-inches, 8312-inches, 8328-inches, 8344-inches, 8360-inches, 8376-inches, 8392-inches, 8408-inches, 8424-inches, 8440-inches, 8456-inches, 8472-inches, 8488-inches, 8496-inches, 8512-inches, 8528-inches, 8544-inches, 8560-inches, 8576-inches, 8592-inches, 8608-inches, 8624-inches, 8640-inches, 8656-inches, 8672-inches, 8688-inches, 8696-inches, 8712-inches, 8728-inches, 8744-inches, 8760-inches, 8776-inches, 8792-inches, 8808-inches, 8824-inches, 8840-inches, 8856-inches, 8872-inches, 8888-inches, 8896-inches, 8912-inches, 8928-inches, 8944-inches, 8960-inches, 8976-inches, 8992-inches, 9008-inches, 9024-inches, 9040-inches, 9056-inches, 9072-inches, 9088-inches, 9096-inches, 9112-inches, 9128-inches, 9144-inches, 9160-inches, 9176-inches, 9192-inches, 9208-inches, 9224-inches, 9240-inches, 9256-inches, 9272-inches, 9288-inches, 9296-inches, 9312-inches, 9328-inches, 9344-inches, 9360-inches, 9376-inches, 9392-inches, 9408-inches, 9424-inches, 9440-inches, 9456-inches, 9472-inches, 9488-inches, 9496-inches, 9512-inches, 9528-inches, 9544-inches, 9560-inches, 9576-inches, 9592-inches, 9608-inches, 9624-inches, 9640-inches, 9656-inches, 9672-inches, 9688-inches, 9696-inches, 9712-inches, 9728-inches, 9744-inches, 9760-inches, 9776-inches, 9792-inches, 9808-inches, 9824-inches, 9840-inches, 9856-inches, 9872-inches, 9888-inches, 9896-inches, 9912-inches, 9928-inches, 9944-inches, 9960-inches, 9976-inches, 9992-inches, 10008-inches, 10024-inches, 10040-inches, 10056-inches, 10072-inches, 10088-inches, 10096-inches, 10112-inches, 10128-inches, 10144-inches, 10160-inches, 10176-inches, 10192-inches, 10208-inches, 10224-inches, 10240-inches, 10256-inches, 10272-inches, 10288-inches, 10296-inches, 10312-inches, 10328-inches, 10344-inches, 10360-inches, 10376-inches, 10392-inches, 10408-inches, 10424-inches, 10440-inches, 10456-inches, 10472-inches, 10488-inches, 10496-inches, 10512-inches, 10528-inches, 10544-inches, 10560-inches, 10576-inches, 10592-inches, 10608-inches, 10624-inches, 10640-inches, 10656-inches, 10672-inches, 10688-inches, 10696-inches, 10712-inches, 10728-inches, 10744-inches, 10760-inches, 10776-inches, 10792-inches, 10808-inches, 10824-inches, 10840-inches, 10856-inches, 10872-inches, 10888-inches, 10896-inches, 10912-inches, 10928-inches, 10944-inches, 10960-inches, 10976-inches, 10992-inches, 11008-inches, 11024-inches, 11040-inches, 11056-inches, 11072-inches, 11088-inches, 11096-inches, 11112-inches, 11128-inches, 11144-inches, 11160-inches, 11176-inches, 11192-inches, 11208-inches, 11224-inches, 11240-inches, 11256-inches, 11272-inches, 11288-inches, 11296-inches, 11312-inches, 11328-inches, 11344-inches, 11360-inches, 11376-inches, 11392-inches, 11408-inches, 11424-inches, 11440-inches, 11456-inches, 11472-inches, 11488-inches, 11496-inches, 11512-inches, 11528-inches, 11544-inches, 11560-inches, 11576-inches, 11592-inches, 11608-inches, 11624-inches, 11640-inches, 11656-inches, 11672-inches, 11688-inches, 11696-inches, 11712-inches, 11728-inches, 11744-inches, 11760-inches, 11776-inches, 11792-inches, 11808-inches, 11824-inches, 11840-inches, 11856-inches, 11872-inches, 11888-inches, 11896-inches, 11912-inches, 11928-inches, 11944-inches, 11960-inches, 11976-inches, 11992-inches, 12008-inches, 12024-inches, 12040-inches, 12056-inches, 12072-inches, 12088-inches, 12096-inches, 12112-inches, 12128-inches, 12144-inches, 12160-inches, 12176-inches, 12192-inches, 12208-inches, 12224-inches, 12240-inches, 12256-inches, 12272-inches, 12288-inches, 12296-inches, 12312-inches, 12328-inches, 12344-inches, 12360-inches, 12376-inches, 12392-inches, 12408-inches, 12424-inches, 12440-inches, 12456-inches, 12472-inches, 12488-inches, 12496-inches, 12512-inches, 12528-inches, 12544-inches, 12560-inches, 12576-inches, 12592-inches, 12608-inches, 12624-inches, 12640-inches, 12656-inches, 12672-inches, 12688-inches, 12696-inches, 12712-inches, 12728-inches, 12744-inches, 12760-inches, 12776-inches, 12792-inches, 12808-inches, 12824-inches, 12840-inches, 12856-inches, 12872-inches, 12888-inches, 12896-inches, 12912-inches, 12928-inches, 12944-inches, 12960-inches, 12976-inches, 12992-inches, 13008-inches, 13024-inches, 13040-inches, 13056-inches, 13072-inches, 13088-inches, 13096-inches, 13112-inches, 13128-inches, 13144-inches, 13160-inches, 13176-inches, 13192-inches, 13208-inches, 13224-inches, 13240-inches, 13256-inches, 13272-inches, 13288-inches, 13296-inches, 13312-inches, 13328-inches, 13344-inches, 13360-inches, 13376-inches, 13392-inches, 13408-inches, 13424-inches, 13440-inches, 13456-inches, 13472-inches, 13488-inches, 13496-inches, 13512-inches, 13528-inches, 13544-inches, 13560-inches, 13576-inches, 13592-inches, 13608-inches, 13624-inches, 13640-inches, 13656-inches, 13672-inches, 13688-inches, 13696-inches, 13712-inches, 13728-inches, 13744-inches, 13760-inches, 13776-inches, 13792-inches, 13808-inches, 13824-inches, 13840-inches, 13856-inches, 13872-inches, 13888-inches, 13896-inches, 13912-inches, 13928-inches, 13944-inches, 13960-inches, 13976-inches, 13992-inches, 14008-inches, 14024-inches, 14040-inches, 14056-inches, 14072-inches, 14088-inches, 14096-inches, 14112-inches, 14128-inches, 14144-inches, 14160-inches, 14176-inches, 14192-inches, 14208-inches, 14224-inches, 14240-inches, 14256-inches, 14272-inches, 14288-inches, 14296-inches, 14312-inches, 14328-inches, 14344-inches, 14360-inches, 14376-inches, 14392-inches, 14408-inches, 14424-inches, 14440-inches, 14456-inches, 14472-inches, 14488-inches, 14496-inches, 14512-inches, 14528-inches, 14544-inches, 14560-inches, 14576-inches, 14592-inches, 14608-inches, 14624-inches, 14640-inches, 14656-inches, 14672-inches, 14688-inches, 14696-inches, 14712-inches, 14728-inches, 14744-inches, 14760-inches, 14776-inches, 14792-inches, 14808-inches, 14824-inches, 14840-inches, 14856-inches, 14872-inches, 14888-inches, 14896-inches, 14912-inches, 14928-inches, 14944-inches, 14960-inches, 14976-inches, 14992-inches, 15008-inches, 15024-inches, 15040-inches, 15056-inches, 15072-inches, 15088-inches, 15096-inches, 15112-inches, 15128-inches, 15144-inches, 15160-inches, 15176-inches, 15192-inches, 15208-inches, 15224-inches, 15240-inches, 15256-inches, 15272-inches, 15288-inches, 15296-inches, 15312-inches, 15328-inches, 15344-inches, 15360-inches, 15376-inches, 15392-inches, 15408-inches, 15424-inches, 15440-inches, 15456-inches, 15472-inches, 15488-inches, 15496-inches, 15512-inches, 15528-inches, 15544-inches, 15560-inches, 15576-inches, 15592-inches, 15608-inches, 15624-inches, 15640-inches, 15656-inches, 15672-inches, 15688-inches, 15696-inches, 15712-inches, 15728-inches, 15744-inches, 15760-inches, 15776-inches, 15792-inches, 15808-inches, 15824-inches, 15840-inches, 15856-inches, 15872-inches, 15888-inches, 15896-inches, 15912-inches, 15928-inches, 15944-inches, 15960-inches, 15976-inches, 15992-inches, 16008-inches, 16024-inches, 16040-inches, 16056-inches, 16072-inches, 16088-inches, 16096-inches, 16112-inches, 16128-inches, 16144-inches, 16160-inches, 16176-inches, 16192-inches, 16208-inches, 16224-inches, 16240-inches, 16256-inches, 16272-inches, 16288-inches, 16296-inches, 16312-inches, 16328-inches, 16344-inches, 16360-inches, 16376-inches, 16392-inches, 16408-inches, 16424-inches, 16440-inches, 16456-inches, 16472-inches, 16488-inches, 16496-inches, 16512-inches, 16528-inches, 16544-inches, 16560-inches, 16576-inches, 16592-inches, 16608-inches, 16624-inches, 16640-inches, 16656-inches, 16672-inches, 16688-inches, 16696-inches, 16712-inches, 16728-inches, 16744-inches, 16760-inches, 16776-inches, 16792-inches, 16808-inches, 16824-inches, 16840-inches, 16856-inches, 16872-inches, 16888-inches, 16896-inches, 16912-inches, 16928-inches, 16944-inches, 16960-inches, 16976-inches, 16992-inches, 17008-inches, 17024-inches, 17040-inches, 17056-inches, 17072-inches, 17088-inches, 17096-inches, 17112-inches, 17128-inches, 17144-inches, 17160-inches, 17176-inches, 17192-inches, 17208-inches, 17224-inches, 17240-inches, 17256-inches, 17272-inches, 17288-inches, 17296-inches, 17312-inches, 17328-inches, 17344-inches, 17360-inches, 17376-inches, 17392-inches, 17408-inches, 17424-inches, 17440-inches, 17456-inches, 17472-inches, 17488-inches, 17496-inches, 17512-inches, 17528-inches, 17544-inches, 17560-inches, 17576-inches, 17592-inches, 17608-inches, 17624-inches, 17640-inches, 17656-inches, 17672-inches, 17688-inches, 17696-inches, 17712-inches, 17728-inches, 17744-inches, 17760-inches, 17776-inches, 17792-inches, 17808-inches, 17824-inches, 17840-inches, 17856-inches, 17872-inches, 17888-inches, 17896-inches, 17912-inches, 17928-inches, 17944-inches, 17960-inches, 17976-inches, 17992-inches, 18008-inches, 18024-inches, 18040-inches, 18056-inches, 18072-inches, 18088-inches, 18096-inches, 18112-inches, 18128-inches, 18144-inches, 18160-inches, 18176-inches, 18192-inches, 18208-inches, 18224-inches, 18240-inches, 18256-inches, 18272-inches, 18288-inches, 18296-inches, 18312-inches, 18328-inches, 18344-inches, 18360-inches, 18376-inches, 18392-inches, 18408-inches, 18424-inches, 18440-inches, 18456-inches, 18472-inches, 18488-inches, 18496-inches, 18512-inches, 18528-inches, 18544-inches, 18560-inches, 18576-inches, 18592-inches, 18608-inches, 18624-inches, 18640-inches, 18656-inches, 18672-inches, 18688-inches, 18696-inches, 1871

angle or side drive shafts. The cylinder block and drive shafts are connected by universal joints so arranged that it permits constant velocity in the cylinder block, thus allowing the piston and connecting rods to be arranged as much as desired. They always remain parallel with the cylinder bore. In this way no side thrust is imparted to the piston and the piston thrust is delivered through the piston rod directly to the drive shaft. The piston connecting rod assembly is balanced and all vibration together with the drive study, the movement of the piston and connecting rod, and the movement of the cylinder block and the cylinder plate. This latter plate contains the intake and outlet ports and a consistency with respect to its exhaust ports.

In operation the patient rotates in a plane at right angles to the drive shaft, and at the same time the cylinder block rotates in a plane at an angle in that of the patient. This action creates a range of motion of the patient in relation to the cylinder. As the group rotates around the cylinder, their movement away from the cylinder is resisted by the cylinder head which is held in the plate and contains air until the patient has completed his movement away from the cylinder head and then a full charge of air is drawn into the cylinder. As the patient begins his strike back, the air in the cylinder then releases, creating a pressure wave in the water and air which drives the patient forward all the air out to the pressure point of the swim.

Another large manufacturer of Rotary Axial Pumps is the Pump Engineering Service Co. of Cleveland, Ohio. As can be seen in Fig. 11, the design and construction of this pump is almost identical with the Western unit, and its operation, that is, also true.

Both the Vibram and the Prata Pump are receiving enthusiastic welcome at the arborist hydraulic industry, and many new applications have been found, for these pumps fit the new hydraulic systems designed to special

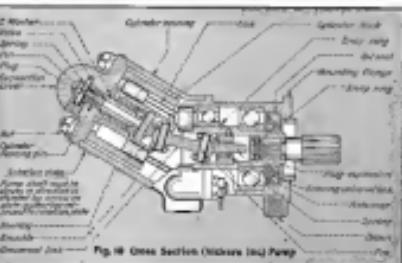


Fig. 18 Cross Section (Side View) Pump



The B-7 collected the two downed French

between 1500 and 2000 lb per square inch. Above these pressures, limitations which control their use are as follows. The

weaknesses of this type of pump lies in the fact that sealing is accomplished by the rotation of the cylindrical blank on a stationary valve plate. It can readily be seen that two flat surfaces containing supports and slots sliding over each other

is a high rate of open valve overtravel which causes trouble. If a chip or a piece of metal gets stuck its way between them and creates deep scratches, leakage of gas will result. Even at low pressure, leakage between these sliding surfaces can be very large and for this reason a driven plug is preferred.

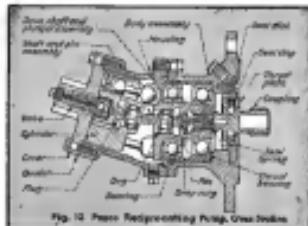


Fig. 12. Same. Reduction to a lower dimension.



PEEL OFF

*from waste and delays
in Plane-Production*

Sight straight on your objective—lowest costs and lower rate of rejection—and hold your course on a straight line.

with the help of Weeden Root Counting Devices on every production machine. These devices will give you hourly or daily facts-in-figures that will show how production stands with each machine and with the plant as a whole.

machines, and win the point as a whole. Show you, too, any slow spot anywhere along the line, and any localized inefficiency that might impair quality. Write (mentioning your DeLaval Contract Order Number), or Veedar-Roof Inc., Stamford, Conn.



WEEDER-ROOT



With HANNIN PUSH-TITE air hose coupling there is no waste of air, energy or money—a tight push of the plug into socket and it is not only completely sealed but the air is automatically turned on. Action right away. An easy pull back on sleeve, it is disconnected instantly and air is automatically shut off.

Hansen Push-Tite couplings are tight, absolutely no leakage at any pressure. No twisting or tarring of pipe-to-connect or disconnection; it's merely a matter of push and pull. Hansen Push-Tite coupling is designed so that complete severing action prevents leaking or twisting of hose.

Write for free catalog

Hansen MFG. CO.
INDUSTRIAL AIR LINE EQUIPMENT
1786 E. 27TH STREET • CLEVELAND, OHIO

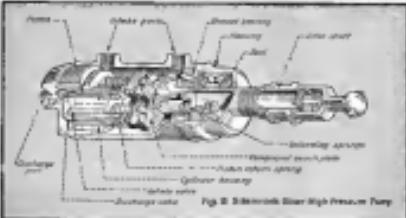


Fig. 2. Bimotronic Silver High Pressure Pump.

highest pump in the world today for the work it is capable of performing.

The American designs have been able to further improve this pump to give an extremely high suction pressure for strike and fighter and the rest so that the American airplane manufacturers will have a strong market position to offer. Presently there will probably be other replacements.

As can be seen in Fig. 3, the Standard Silver variable displacement constant pressure pump consists mainly of impellers and unique details of construction. The pump consists of easily arranged power closely fitted into their cylinders. These cylinders are made of the same type material as the piston so that temperature changes will not affect the piston's performance. The cylinders are sheathed in a durable, heat resistant, flexible covering, thus giving a strong light weight. A valve housing which contains intake and discharge check valves is fitted on the cylinder housing. The ends of the surfaces of both of these parts is at 90° from the leakage between them does not occur. The valve housing is drilled so that passage from the center of the pump goes to the intake ports of each pump. The intake port is located below the discharge valve in each pump to the discharge port of the pump. A cover housing containing the discharge port covers the cylinder housing and valve housing together as a small compact sub-assembly. It should be pointed out that each pump has its own intake and outlet bell check valves which are added with the addition of cylinders. Pairs are all metal to avoid wear and are dimensioned by extra fine finish and high precision to withstand the sealing wear. Inherent pressure in the pumping action further aids in preventing leakage by applying pressure to the discharge, opposing leakage.

The pumps are operated by a compound variable plate composed of a half bearing and a cap that is separated by half bearings retained in a dimensioned half ring. The capitive part is

held to the drive shaft at an intermediate. The drive shaft is hollow to provide a housing for a pre-loaded spring. This assembly engages a collar sleeve against the capitive part maintaining the variable plate in its extreme position. The pump housing contains two ports through which intake into the pump is controlled action to cost the pump to take place.

In operation, oil is drawn from the center of the pump entering an annular space around the valve distributor disc. As the variable plate rotates, openings on such ports pull the pump out from driving the oil into the cylinder. The downward drive is accomplished by the three of the variable plate which forces the fluid into the discharge port. The non-return check valves prevent back flow. Constant pressure is maintained by the presence of the discharge port lead-in to the seating on the spring housed in the drive shaft. After this the bushings on the variable plate overbalance the spring and gradually seal the variable plate housing venturi. Thus the values of the oil delivered gradually decreases so that the variable plate is vertical at stroke and therefore on delivery is automatically stopped. In this way the pump rotates evenly, constant movement occurring in the system and checks leakage or power from the engine.

The variable pumping principle has many advantages and answers in many ways the problems of the aircraft hydraulic designer. Elimination of the underdrive valve, thus preventing shocks due to leakage and actuating, and the elimination of accumulators with controllers by moving up to the oil filter provide a number of auxiliary parts. Inherent pressure in the pumping action further aids in preventing leakage by applying pressure to the discharge, opposing leakage.

The pumps are operated by a compound variable plate composed of a half bearing and a cap that is separated by half bearings retained in a dimensioned half ring. The capitive part is

held to the drive shaft at an intermediate. The drive shaft is hollow to provide a housing for a pre-loaded spring. This assembly engages a collar sleeve against the capitive part maintaining the variable plate in its extreme position. The pump housing contains two ports through which intake into the pump is controlled action to cost the pump to take place.

In keeping with this policy of extending education to the industry and due to many requests, the authors are departing from their usual article to discuss specific topics in mechanics to publication in the next issue of *Aircraft Hydraulics*: Testing and Maintenance.¹

Corrections. Due to an error, it was stated in the previous article in this issue that the Bimotronic pump maximum extension of 100 inches. This should read .0905 (inches distance). Also, it should be noted that Bimotronic Aviation has succeeded in establishing the German plane records of endurance, height record of 10,000 pounds per square inch as stated in the November article.

Rebirth of R.A.F.

(Continued from page 281)

Tactical Training Command—Air Vice-Marshal J. T. Shenton;
Maintenance Command—Air Marshal G. B. Bailey;
R.A.F. Flying Command—Air Chief M. S. P. Freeth Royal Air Force.

The Army Cooperation Command

To the Army from the Army Cooperation Command of the R.A.F. has the closest interest. This was formed in November, 1938, "after joint consideration by the War Office and the Air Ministry of how best to secure the most effective co-operation between the Army and the Royal Air Force". It comprises all squadrons allotted to Army formations in the United Kingdom, together with associated training units. Every formation of the Command is to organize, control, and maintain its own form of cooperation between the air and land services. The operational employment of the Army Co-Op squadrons rests with the commandants of the Army formations to which the Squadrons are allotted.

Air Marshal Sir Arthur Barratt, an old pioneer officer and former Com-C of the British Air Forces in France, is Air Officer Commanding-in-Chief.

Just Out!

AIRPLANE LOFTING

By WILLIAM NELSON
Captain, U. S. Navy (Retired)

347 pages, \$6.50; illustrations \$1.40

This concise, practical book is the first to be published on the lay off of airplanes in the model loft, and gives you a real understanding of airplane lofting work. It clearly explains the methods, techniques and principles of laying off according to basic procedures in the industry. Clear-cut explanations of the making of models, planer development, template making, etc., are given. Latest progress in mechanical and photographic reproduction as applied to lofting is incorporated at a special chapter.

**Some of the
practical topics
discussed:**

- and how they
are used
- using and making
models
- drill expansion
- camber
- cambers and latencies
- cambs and webs
- camber
- cambers
- cambered devices

**McGRAW-HILL
ON-APPROVAL COUPON**

McGraw-Hill Book Company, Inc.
122 East 45th Street, New York 17, N. Y.
Send me 30 days' examination copy of *Airplane Lofting*. At the end of 30 days I expect to return the book unconditionally. If I do not do so, I will enclose \$6.50, plus postage, to secure possession of the book.

Name _____

Address _____

City and State _____

Zip _____

Comments _____

Check here if you want an express mail. Add 50¢ extra postage.

Print Name _____



A NEW life in flight, smooth drafting opened when Bruning did some serious research on the subject of making a draftsman's thumb more useful.

For that research resulted in the Bruning® White Touch Control Drafting—embodiment the “reach control” principle that brings new ease and simplicity to the drafting process. The control handle, always under the draftsman’s thumb, makes control of the pen or marker head positively automatic. No need to fumble for an inconvenient drafting tool—drafting tools are cut still further—drafting time reduced from one quarter to one half.

Making drafting easier—more accurate—less costly is the big job to which the Charles Bruning Co. has dedicated itself since 1887. See a Bruning representative—find out for yourself why “Bruning progressive drafting tools” are designed to satisfy requirements of even the most exacting.

Charles Bruning Co., Inc., 100 Route St., New York, N. Y.

BRUNING

Since 1887

SPEEDS—SIMPLIFIES—IMPROVES A NATION'S DRAFTING
New York • Chicago • Los Angeles • Boston • Detroit
Houston • Newark • Kansas City • Milwaukee • St. Louis
Pittsburgh • San Francisco • Seattle



Celluloided hose is oil-proofed with multiple layers of cellulose, a material completely resistant to hydrocarbons, kerosene, hot oils, etc.

BURST PRESSURES to 23000 P.S.I. Great strength of Celluloided hose is obtained by embedding metal braid covering in the synthetic coating.

SIZES $\frac{3}{16}$ " I.D.
to 1 INCH I.D. (braid)

Available sizes of Celluloided hose (I. D. measurements):
 $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{1}{2}$ ", $\frac{9}{16}$ ", $\frac{5}{8}$ " and $\frac{3}{4}$ ".

CELLU-SEAL COUPLINGS

Couplings for Celluloided hoses are available with standard I. P. T. or S. A. E. threads.



Write for Catalog and Engineering Accommodations on specific problems involving flexible connections.

CHICAGO METAL HOSE CORPORATION

MATWOOD, ILLINOIS

another leading with very little loss. Precision is assured by the use of heavy leveling plates and castings at all key points. For example, on the main baseplate plus both nose and tail sections, a single large casting is set into the jig at the cross-sectional interface plates, or transverse parting line along which each major frontage assembly will be assembled to the main fuselage section. Since the outer bay of the fuselage in question contains the right rear engine plates, location of the main assembly operation is assured. Furthermore, whenever major sub-assemblies are gathered large rigid plates or casting with leading holes and precision machined form are positioned into the jig structure. On the main wing assembly large plates are provided at the points of outer wing panel attachment, engine mount struts, and leading gear struts.

There is quite a story back of these jig plates or castings. There are a dozen long stories with Consolidated in that they are cast from scrap aluminum alloy parts salvaged from plane wrecks. Such light alloy material is easy to cast and machine and represents voluminous conservation of scrap material. Such castings are prepared in a variety of standard plate sizes from which jig features can be most easily prepared. Each group of jigs is designed to exactly so designed that its location may be shifted easily to meet severe damage changes without disturbing the original mounting plates.

Each or table assembly of many smaller sections, such as nuts, bolt heads, and bushings is also done on multiple stations. A process developed at Consolidated recently and known as the Taber-Van Dusen Method, makes it possible to reproduce bolt layouts with maximum accuracy. After the layout of the nuts, bolts, or other minor assemblies are transferred to any required number of the boards which serve as table tops. Positioning blocks for holding parts on the table top are Elastomeric made to withstand and then removed directly in these tables. Transfer of bolt holes is accomplished through drilling a hole into the negative of the original layout and by means of a selection pinning process. From the negative the holes are transferred in a dark room to the required hole type. Balanced control is widely used for such positioning blocks and tables. This system assures complete accuracy of assembly yet cuts time required for preparation of fixtures to a fraction of that previously required.

Major sub-assemblies are no exception to this accuracy and a well serve in the major sub-assemblies and design the procedure followed. Major assemblies are the wing and fuselage. The wing is broken down into major sub-assemblies



HEADQUARTERS FOR

CARBURIZING AND ANNEALING BOXES

THERMOCOUPLE PROTECTION TUBES

SEAMLESS STEEL CYLINDER CAPS

SEAMLESS STEEL NECK RINGS

WELDED ALLOY TUBING FOR HIGH TEMPERATURE CORROSIVE APPLICATION

RADIANT TUBES

INNER COVERS AND

BASE SHEATHS FOR STEEL MILLS



THE PRESSED STEEL COMPANY

WILKES-BARRE, PA.

Branch Office: 107 Gothic Hwy., Bettontown, Pa. Vermont Ave., Toledo, Ohio. 220 Madison Street, Chicago, Ill. 236 W. 31st St., New York City.

Flawless Fabrics

FOR AIRCRAFT CONSTRUCTION

HERE is another way in which we test every yard of AIRWING Fabrics. Under heavy lights the cloth passes slowly before the eyes of skilled operators who can spot the slightest flaw.

Though it's not unusual by specification, this one is new, what every AIRWING Fabric must pass. It is slow proof of the fact that the AIRWING label must be earned in exacting tests in Thurston's own laboratories.

If you are manufacturing airplanes or gliders, or you sub-contract static-covered surfaces, you should know all about AIRWING Fabrics and Tapes. The AIRWING line is complete, including such specialties as self-laminating tapes, insulation, and the like. These organizations are well known for their ability to create special fabrics for special purposes. If you are seeking a new fabric for your use on aircraft, let us know your needs.

Send for Airplane folder containing schedules of several drawing Fabrics and Tapes.



W. HARRIS THURSTON

THURSTON CUTTING CORPORATION

Box 600, Plainview, New York, N. Y., U. S. A.
Laboratory, Casting Facility and Workroom
W. H. Thurston Co., New York, N. Y. U. S. A.

consisting in the outer structure, center nose and trailing edge assemblies, center panels, flaps and rudder. There are many smaller subassemblies feeding into each of these major operations. The main landing struts also have two major sub-assemblies, the nose and tail portions. The tail portion incorporates many minor assemblies but is not itself breakable. However, the nose assembly is broken down into a group of major sub-assemblies in a logical way, resulting in major time savings in the installation of control instruments, plumbing, wiring, etc.

Other major assemblies are the engine components, engine mounts, landing gear assemblies, gun barrels, bomb racks, load doors, control surfaces, wing flaps, etc.

All of the assemblies and sub-assemblies mentioned above were designed in the same manner. The first and last in the mainland lead assembly, Inc. Order of assembly along this lead power driven line is by recursive iteration, as follows: Station 1 is J 2 assembly center wing and center fuselage, or bomb bay; Station 3 is M 2 assembly of fuselage nose and tail sections and landing gear to center wing and fuselage assembly; Stations 3 to 20 narrative center wings, ailerons, canards, etc., and engines; Station 36 is M 45 assembly; the F-86, was the last. Station 44 the last, and 24 assembly the gun barrels, pilot's overhead console, bomb well doors and propellers. The plane is then shipped out for final engine test and ground adjustment prior to flight.

Returning now to primary work done in the parts plant, all primary production starts with processing of raw sheet stock. Sheet development is handled at the request of the F-86 Assembly Department. Material price, for the largest parts, and a smaller 140-ton Vieron Sheeting press for the smaller sheet parts. Considerable use is also made of a battery of shears including several of the Merrill square shears. But it is to be noted that the practice of profiling sheet of sheet by means of high speed swinging-shears, or paragraph presses, is not followed by Consolidated. We have found that the use of such equipment through working with Kirschbaum, a standard plow and puncher. Probably we are among the first to use Kirschbaum for large scale blanking operations, although the practice is now coming into more general use. Kirschbaum is a special hard alloy of steel. We use it in the form of ruled plate stock which is welded to the outside of the part we wish to blank out. Such is stand up well for the quantity requirements, are quick, easy and cheap to make, and have a high percentage of salvage.

Our stamping operations of flat sheet material follow standard shop practices and press pressure ranges that the drop hammer is all of air or hydraulic type, rather than hand controlled by means of rope lifts. There are various advantages for the air operated hammers. Our press stock largely follows the established Green's process of using a roller blower in place of one set of dies and a press stand.

The entire process is closely characterized by the great use of modern machinery, and by frequent use of dies. We have a Kellendorf gap before merging parts of 6 ft. diameter, and blunting hard stress surfaces working down to 4 ft. diameter. For precision drilling and forming of fuel tank mounting flanges, engine support plates, etc., we operate a battery of radial drills ranging over a radius of 6 ft.

Precision machining of frames, engine, gear and control arms, etc., is done by the most modern methods available in aircraft building. We have a wide variety of parts going through the machine shop that would be difficult to classify as typical. One of the interesting newer machining problems was that of finishing the "wing gun right" air strake split, "lugged" used as large members on every wing. This part, though small, particularly vulnerable to damage, must be machined straight through the tail part of the structure. The tail part of the structure is very slender. Since the largest machined part of the structure is a 10 ft. long spar, the specification calls for a tolerance of 15 mils a straitening operation is first done by hand in a precision lathe. The part is then mounted in a chuck operating another lathe for pulling the tail of the lugged section straight. This is done on a Cincinnati mill, refacing the special tailing feature so that a ready difficult straightening job can be done.

Another series of four hole holes in front drilled in each arm of the frame on a Novo multiple spindle drill point, using a two-blade drill cut-up with four blades in each hole, and a reversible driver for drilling opposite ends of the bearing. A final drilling operation provides holes in the bearing flange for riveting it into the fuel tank well with a high-speed grinder.

The main wing structure is assembled in a fixture of 40 ft. x 10 ft. This fixture holds the main part of the structure between the two main planes, and between the two nose planes, and between the two nose spars. Assembly parts are of two-level construction, with precision plates positioned at all points of attachment for additional strength. Parts are hot cut, as with all other assembly operations, from an adjacent stock room extending along the factory of jets, Spars, ribs, and major strings incorporated in the structure we first positioned in that jet. Spars were straightened, then located and clamped to bolted in place. Final operations to attachmen

ts in the thickness up to a maximum of 136 mils. The skin is attached by means of Cleco clamps, drilled, crimped and then cleaned with flux-coat over the entire upper surface. Standard round head rivets are used on the under side, departing with the counter sinking operation. Wing assemblies are lifted out by the overhead crane system from any point along the line and moved to a lead assembly line where cross-tensioning and straightening work is done prior to disassembly and main wing structure for final assembly.

A similar procedure is followed on assembly of the outer wing panels and other major sub-assemblies of the wing.

The main fuselage section is also assembled in a two-level rig. First assembly is to position the tail frames and left-hand in the rig, using quick acting cam clamps for holding them. Longitudinal and transverse beams are then located and riveted to them in place. Final operation is cleaning down to an air line, straightening the shear in the frames, then drilling rivet holes through the pre-punched holes in frames and struts, after which final riveting is done. The complete fuselage section can be lifted out of the rig in about four minutes and is complete only just before it is set up in the parts bays and change for the next run of fuselage frames.

During the early stages of the production of the fuselage is similar to that just described. There is a major difference, however, in that this section, which incorporates the pilot and bombardier, together with a complete installation of controls, plumbing, wiring, etc., is built so that it can be taken apart quickly along four cutting lines. At these points the connection is not riveted but is held with lock screws, and the web frames and panels hold them in place until removable bolts are then driven the parting lines. Upon removal from the assembly line this nose section is transferred to a building where a break-down is made into five sections. These are the top, bottom, left side, right side, and pilot's cockpit floor. Each of these sections is mounted on special jacks and all come down five jacks simultaneously. The top section is then separated from bottom, search lights, and other nose parts, and accessories pass to final assembly at the far end of the line.

It will be obvious that this major practice breaks the important nose section open for the easiest possible handling of the most difficult of all jobs, installation of equipment. It is thought that we reduce required factory space and increase speed of our installations work by about 300 per cent through breaking down the part of the fuselage into five sections. Since all sections were originally made together there is no difficulty in re-assembling them and con-



A PROFESSIONAL SERVICE TO AIRPORTS FOR THE PRODUCTION AND MAINTENANCE OF PROPER TURF CONDITIONS

Proper turf building is of primary importance to every airport, affecting great economies when drainage, irrigation and soil problems are carefully considered, as well as current grass seed and fertilizer formulas indicated for different sections of the country.

Turf production and maintenance of large grass areas have been an important part of our business for many years. In an advisory capacity we have nothing to sell but the services of the men on our staff who, through training and long experience, have qualified in this highly specialized work.

We cordially invite your inquiries with no obligation on your part.

ARTHUR D. PETERSON COMPANY, Inc.
426 Lexington Avenue, New York, N.Y. MURKIN 4-4351



**INTERNATIONAL FLARE-SIGNAL DIV.
of THE ALIS-CHALMERS CO., Toledo, Ohio**



B-A-30
Boeing Aircraft

B-A-30 aircraft wing slats, famous for
its aerodynamic, high-lift, stronger and more
steely wings than other aircraft fabrics.

**WELLINGTON SEARS COMPANY
65 Worth Street
NEW YORK CITY**

pling the fluid stream through rinsing the parts permanently in place. With most of the insulation work done along the insulation installation lines there is eliminated the period during which it is necessary for a large area to proceed into the re-insulated wire section and complete the bonding of all plumbing, wiring, etc. This avoids the old lagging-to-wire bonding, the problems of wires of many sizes being even and other to perform their insulation task. And it is especially important to note that even on this, the largest military aircraft in production in this country, if used in the world, it is vital to break down the most congenital part of the airplane, the fuselage, so that a greater concentration of man power can be applied to this important insulation work. While it has not actually been mentioned in this article, it must be said that

a most important part of the whole production process which has been described is the planning and scheduling and checking of the flow of all parts and materials so that they arrive at the right place in the right time for incorporation in the airplane without breaking the tempo of assembly work. This is largely a matter of careful bookkeeping and overall work, a feature at which Americans have excelled for generations, so we need not go into problems on that.

The B-26's are rolling along the assembly lines and out of the multiple factories now dedicated to their manufacture.

They are rolling along the runways of every nation in the world. And the think of their engines in the drum beat of doom for the enemies of Democracy.

Building Franklin Engines

(Continued from page 29)

welds. The parts are then attached to the connecting rods and the cylinders set in place by the cylinder assembly studs and nuts (See Fig. 2). Next on the assembly line comes engine No. 3, where the pumps are sub-assembled and tested, piston, piston and magnets gears selected, and the takeover drive is assembled. With these in place the engine moves on to where the valves are put in their proper seats and set into the regulating cams and rocker arms to operate at 4,000 rpm. In another section (See Fig. 4) the valves where the valve rocker arms and shafts are mounted are given initial adjustment.

As can be seen, the engine at this point is almost completely assembled, working only for the accessories, oil pump and other parts that are added to the main parts of the engine. Figs. 2, 3 and 5 show a few of these final operations which prepare the engine for the final inspection. This inspection is being carried out just before the engine is ready for the test stand.

One of the final operations preceding to testing is shuddering the engine for leaks. This is accomplished by attaching an oil line, which is under pressure, to the engine and then watching to see if any leak develops (Fig. 5). A specified pressure is used which complies with the design of the engine. If everything checks satisfactorily here, the engine is turned over to the test stands for operation.

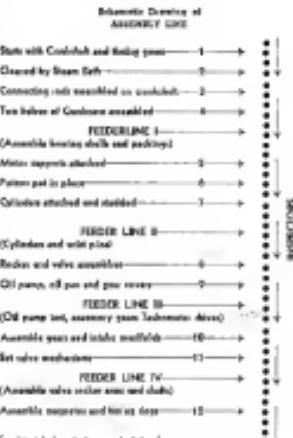
Not only is this type of an assembly line efficient in that it cuts out needless storage, but it also cuts down

New Book

STORMAN AIRCRAFT World's Manual—Howard Lounsbury, Editor. Published by Fletcher Aircraft Schools, Berkley, Calif., 1941, Sixth Edition, 8 sections, \$1.50.

A useful reference for engineers and aircraft workers in maintenance operations. Contains illustrations and descriptions of materials and tools and methods of construction used in AN and B standards, dimensions, tolerances, gages, glossary of unconventional terminology, charts, formulas and miscellaneous information. Blank pages are included for notes.

The book is bound with a leather cover and wire binding, making it ideal for pocket or tool box. Many technical experts have collaborated in the preparation of this manual. The eight sections include: Materials and Methods of Aircraft Construction, Aerodynamics and Air Laws; Aircraft Tools; AN and B Standards; Assembly; Structures and Use, Shop Geometry, Sizing and Dimensioning, Shop Prints, Notes and Glossary; Tables, Charts, Formulas



The SUNNEN PRECISION HONING MACHINE is Helping to Speed Up DEFENSE PRODUCTION by Handling Jobs Like These FASTER, More ACCURATELY



Boring and Drilling: Honing a fine bore hole in a steel block.



Drill Bit Honing: Honing a fine bore hole in a steel block.



Bore Hole Drilling: Honing a fine bore hole in a steel block.



Bore Hole Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Boring and Drilling: Honing a fine bore hole in a steel block.



Grinds and finishes internal cylindrical surfaces from .185" to 2.400" with guaranteed accuracy of .0001".

Relieves big internal grinders. Does not require skilled labor! Can be set up in less than a minute. Is saving money, increasing production and improving quality for hundreds of manufacturers handling important defense contracts.



SUNNEN PRODUCTS CO.

1144 Manchester Ave., St. Louis
Sales Office: 301 N. LaSalle St.
Chicago, Illinois

Write for FREE 8-Page Bulletin

giving valuable information on how all SUNNEN products can help you do your job better and save you time and material cost as your job.



Suppose They Bomb!

(Continued from page 109)

could be had on the progress of the war. In a large building several small shelters are preferable to one large one, and those located centrally with no openings except a door at each floor are excellent. Basement shelters should have an emergency exit that does not open into the building. A building that is not fire-resistant should not be used for a shelter. External shelters may be long narrow huts or larger, rectangular buildings. They should be above ground, pass health examinations, if sufficiently deep experience in concrete may be affected, since the earth gives protection. Tunnels must go quite deep for safety, with independent exits and gas protection. The effect of blast may be minimized by making the tunnel square or rounded, or by certain walls. If possible, shelters should be designed with a view to peacetime use, which, however, should not be permitted to detract from the efficiency of the shelter.

The pamphlet contains plans for different type shelters, diagrams, and a bibliography. The publications listed will also be purchased through the British Library of Information, 50 Randolph Place, New York City, Brewster's, 1 W. 47th St., New York City, or any house dealing in foreign publications.

Recent Books

FLAGGISTS, fighter pamphlet prepared by the War Department and issued by the Office of Censorship, Washington, D. C.

"The effectiveness of a blockade system depends upon the knowledge and the conscientious spirit of the people at large," the foreword to the pamphlet says.

Now that we are at war, it will be necessary to learn a lot of things which in time of peace constitute a considerable drudge. This pamphlet, therefore, will form a part of our acquired reading in our new wartime existence.

The first chapter, "Planning the Blockade," describes the purpose, scope, definitions, training and procedure, action after blockade and basic considerations in planning blockades. It bears responsibility for the execution of blockade, fleet legislation and enforcement organization, as well as the education of

the public concerning blockade and the test and nature of lighting restrictions. The second chapter, "Observation Methods and Materials," describes the treatment of general subjects, the use of patrol, submarine instruments and glass etc.

In the third chapter, "Industries and Dwellings," advice on black and tan equipment for short stay, and coast patrols are set out as offered.

Chapter IV, "Shelters, Factories, and Industrial Buildings," deals with coast patrols, the use of mobile emergency communications, measures to protect and ventilation. These chapters should be of particular concern to the industry.

The final two chapters cover utilities and industrial services, electric light and power, and transportation.

AVIATION CADET by Henry R. Lent. 176 pp., illus. The Macmillan Co., \$1.55

This is a very little book well illustrated, telling how Dick Hallinan flies his wings as an Avenger, U.S.N.A.F. From the first day of his enrollment at the Floyd Bennett field, through his training at the Pensacola Naval Air Station, all phases of cadet training are covered, giving a realistic overall picture of the aviator's routine and improving the reader with the satisfaction of serving as a naval aviator in the U. S. Navy.

FIFTY FAMOUS FLYERS, by Oskar Korschelt, with introductions by Dennis Jensen, Claude Denson, Newark, N. J., 56 pp., 15 cents.

Dick Korschelt, aviation editor of the Newark Evening News, did a series of columns of famous fliers for that paper, and now has assembled them in a paper bound book. They are lucidly biographed, and strongly drawn and captioned; all readers will enjoy them and youngsters will love them. Dennis Jensen's introduction alone is more than worth the price—15 cents.

AIRCRAFT DESIGN, VOL. I, AIRCRAFT MECHANICS, by C. H. L. Aerobatics Company, Inc., New York, 327 pages, 144 illustrations. Chemical Publishing Company, Inc., New York, \$6.90.

The book on aircraft design is the first of two volumes and covers the principles of airplane flight and stability. It is written in a style that is not too complicated so that a reader with only the basic engineering background can easily understand the material presented.

The opening chapter deals with the fundamental properties of air and how these affect the theories of flight. In addition to explaining the various experimental methods of determining airplane flight characteristics are discussed following that the author shows the analysis the physical effects of air on an air stream with regard to lift and drag, the angle of attack and lift and drag and the attitude of the aircraft. Having done this the author goes on to discuss the development of the principle of aspect ratio, lift, wing loading, lift coefficient etc.

The last section of the book enters into the calculations of performance, use of high lift devices and a description of the propeller and effect of drag. Although a great deal of the mathematical and theoretical approach to the aerodynamic problems involved is left out, the book should be valuable for one desiring a simple and concise introduction to aeronautical engineering.

PRACTICAL THERMODYNAMICS FOR AIRCRAFT ENGINES, by L. Leslie Thorpe. Published by Aviation Press, San Francisco, Calif. 240 pages Price \$1.95.

One of the Docto Series publications, this work will serve the aerospace engineer as a reference in great numbers of students and technicians a simplified presentation of a technical subject.

As stated in the Preface, a knowledge of thermodynamics is particularly desirable for all men concerned in any capacity with aircraft engines. In this book the essentials of this subject have been presented in quite compact form, differing from other books in that the emphasis is placed on the applications as applied in a matter of addition, subtraction, multiplication and division.

Chapter headings begin with Elementary Principles, closing first with a definition of terms of which the work fundamentally treats. Having thoroughly analyzed these various and closely interrelated terms the reader is then given a brief history of the growth of aircraft operation. His studies will be greatly aided by 42 illustrations and ten diagrams with which the text is supplied.

An effort is made, throughout the discussions, to make practical application of the discussions. The author has endeavored to keep the discussions as simple as possible, yet at the same time giving the reader a clear understanding of the principles involved.

AVAILABLE FOR PROMPT DELIVERY

With production schedules constantly encumbered by availability of mineral materials, the elimination of even one such problem is a valuable aid in maintaining maximum output. Torrington Needle Bearings are available for prompt shipment on your present order.

Right from the start, steadily rising sales caused reduced factory's immediate recognition of the Needle Bearing's advantages. Today bearing engineers are continuing to seek out enhanced materials. Torrington was prompted to expand production capacity again and again, to anticipate growing use of the Needle Bearing.

So broad was the scope of this expansion program, centered in the light of the Research Department's demonstrated potentialities in control times and in response by an array of the country's leading

engineers, that it has passed sufficiently far to care for the thousand requirements of the present.

Manufacturers of aircraft, submarine equipment, textile machinery, farm implements, electrical apparatus, and many other products have put the Needle Bearing to work in thousands of applications, because of such competitive factors as low cost, small size, high rigidity, easy installation, efficient lubrication. And the Needle Bearing has a new and unique important appeal—it's ready availability to the maker of disease suppressors and machines.

You can avoid delays by incorporating the Needle Bearing in your designs because you can profit as well by its availability in the solution of a wide range of bearing problems. Torrington engineers will be glad to work with you in incorporating the advantages of the Needle Bearing in your product. For full details on this unusual bearing, write for Catalog No. 214.

THE TORRINGTON COMPANY
Torrington, Conn.
Division of International Harvester
Sales Offices: Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Houston, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Portland, Seattle, St. Louis, San Francisco, Seattle, Toledo, Wichita, Worcester, and 120 Distributors.
Export Department
London, England
Montreal, Canada
Towing Engineers



TORRINGTON NEEDLE BEARING

REDUCTION IN WEIGHT



standard ball bearing
is replaced by a
precision-constructed
needle bearing.

CRIMPER - WHIRLIE

COMPLETE RELIABILITY



is essential in such
aerostatic bearing
application as the
Towmotor Lift Truck,
which demands
in severe vibration
and heavy loads.

TOWMOTOR LIFT TRUCK

HIGH CAPACITY IN SMALL SPACE



is required by the
use of Torrington
needle bearings on
the motor side of
the Towmotor Lift
Truck, which demands
in severe vibration
and heavy loads.

PICKLEBEDS GOVERNER

Dan Malm, Inc.

Syracuse, N. Y.

Bethel, Maine



1943

THERE
ARE MORE
SNOGOS
IN SERVICE THAN
ANY OTHER MAKE
OF SIMILAR
PLOW!

BECAUSE—

- No banks to endanger wing tips.
- No heavy snow blanket to be scooped up by wheel ports and freeze brakes and landing gear.
- No packed layer of snow to freeze into dangerous rats or break through in mushy spots with every throw.
- No plowing to condition snow.
- No costly repeat plowing or rehandling.

WHEN Snogo gets through the job is done until down to the runway.

Snogo is the only plow of its type with 15 years' actual field experience behind it —

there is no need to experiment.

Remember, one winter will pay for a Snogo!

Kenskunk Field,
E. Hartford, Conn.

St. Paul, Minn.

La Guardia Field, N. Y.

POSITIVELY
GUARANTEED
to handle any
snow condition
that will ever
occur on any
airport!

SN GO

For
Complete
Snow
Removal

KLAUER MANUFACTURING COMPANY

Dubuque • Iowa

and
many
more!

Defense Depends on Open Roads



"AIRACOBRA BEST FIGHTER IN THE WORLD"
SAYS R. A. F.

This biplane flitted around the world as Armadae went into action with the Royal Air Force. These photographs just released by British Censors dramatically illustrate Cobras at the fighting front "somewhere in England."



Making Aviation History

BELL AIRCRAFT CORPORATION
Bell Aircraft Defense Division
SUFIDA AND HAGREN FIELD, N. Y.



ARMAMENT, January, 1942



"Now the old lion with her Lion Cubs at her side, stands alone against horrors who are armed with deadly weapons and impelled by despots and destructive rage . . . but this is not the end of the tale. The Stars in their courses proclaim the deliverance of mankind. Not so easily shall the central message of the peoples be banned, not so easily snuff the lights of freedom die."

Mr. Winston Churchill in a broadcast to America on receiving the honorary degree of Doctor of Laws of Rochester University, U.S.A., June 10, 1941



For dependable operation specify ECLIPSE

AIRCRAFT ACCESSORY EQUIPMENT

STARTING EQUIPMENT



Series 11, Inertial



Series 41
Electric and inertial



A-160 Electric



Combustion



Hand Turning Gear



Solenoid
Relay



Booster
Coil



Control
Switch

GENERATING EQUIPMENT



DC Generator



AC-DC Generator



Detachable Control Box



Standard Control Box



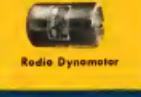
Control Panel



Filter Box



Booster Dynamotor



Radio Dynamotor

AIR PUMP AND DE-ICER EQUIPMENT



Air Pump



Suction
Regulating
Valve



Vacuum
Relief
Valve



Check
Valve



Oil
Separator



Pressure
Relief
Valve



De-icer
Distributor



De-icer
Control

HYDRAULIC EQUIPMENT



Generator
Pump



Generator
Pump—Motor
Driven



Gear Pump—
Motor Driven



E-160 Starter Pump



Super-charger
Regulator



Propeller
Anti-icer
Pump



Anti-icer
Control



Anti-icer
Flowmeter

MISCELLANEOUS EQUIPMENT



Retracting
Motor



Syncroscope



Ammunition
Rounds
Counter



Auxiliary Power Unit



Propeller
Governor
Control



Starter
Energizer



Anti-icer
Flowmeter

Accepted as standard by the Aircraft Industry, Airlines and Military Services for more than 20 years

ECLIPSE AVIATION
DIVISION OF BENDIX AVIATION CORPORATION
BENDIX, NEW JERSEY, U. S. A.

